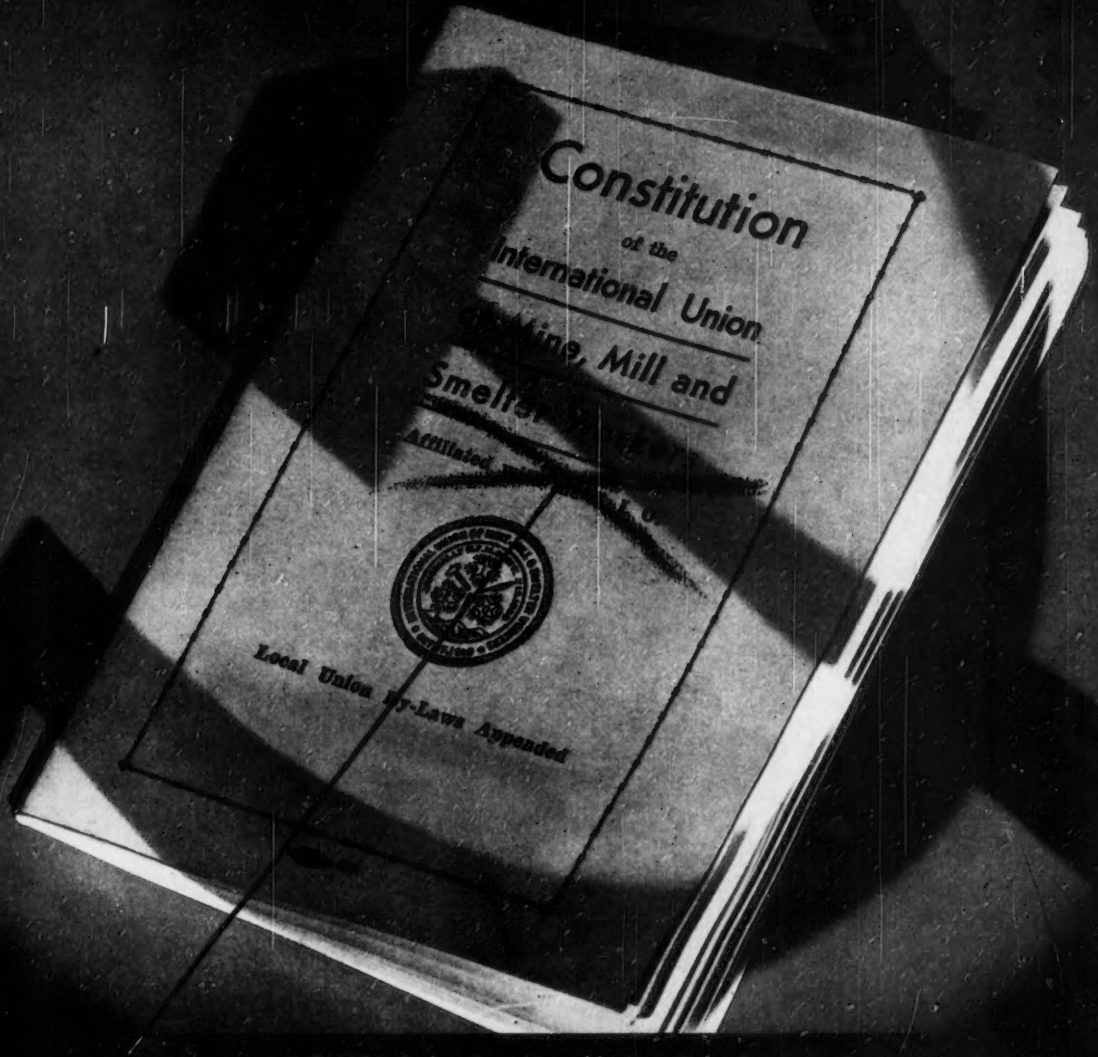
ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

APRIL 1950

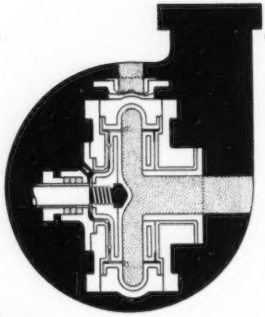
FOUNDED 1866



Does This CIO vs. MINE, MILL Fight Mean Trouble For Your Company? — See page 73

IN MOVING ABRASIVE SOLUTIONS

make your MTS. into mole hills



HYDROSEALING

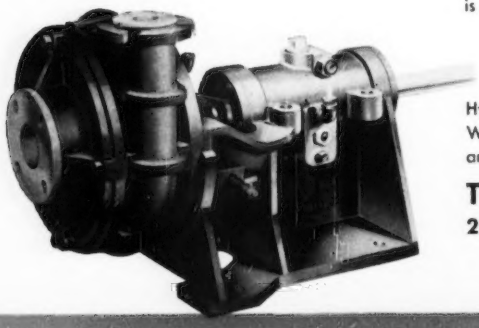
keeps abrasive-laden water out from between the pump's impeller and side-plates —a big factor in the efficiency and economy with which you can pump abrasives anywhere and under any condition in your plant.

Maximix Rubber PROTECTION

Abrasives bounce off Maximix Rubber parts, to which flexibility gives 4 to 6 times the useful life of equivalent parts made of metal.

Continued ENGINEERING

A pumping system with Hydroseal is not only tailor-made for your specific needs, but is followed-up systematically as to performance. This practice assures continued efficiency, and is a basis for our authoritative planning.



When you write for more information on Hydroseals, tell us about your pumping problem in detail. We'll gladly suggest the system that will do your job best and also save you money.

THE ALLEN-SHERMAN-HOFF CO.

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HYDROSEAL

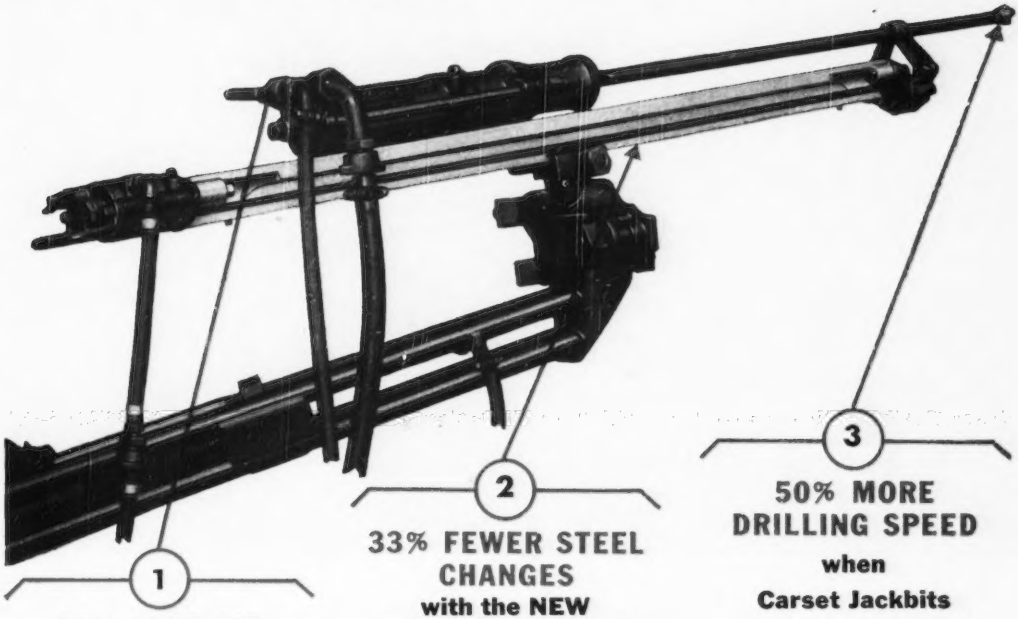
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

HYDROSEAL, PACKLESS AND MAXIMIX DESIGNS ARE COVERED BY PATENTS AND APPLICATIONS IN THE MAJOR MINING CENTERS OF THE WORLD

THIS NEW

DB-35 DRIFTER and 48" ALUMINUM SHELL

SAVES THREE WAYS!



1

28% LESS AIR with the NEW DB-35 Drifter

Ingersoll-Rand's new DB-35 Drifter, with the patented double-kicker port valve, has been especially designed to increase operating economy. Tests prove that this new drifter actually requires 28% *less air* per foot of hole drilled! What's more, the new design has resulted in stronger rotation, better hole cleaning ability and improved feeding qualities. These combined features give you a rugged, heavy-duty drifter that will even surpass the record-breaking performance of Ingersoll-Rand's famous DA-35 Drifter.

2

33% FEWER STEEL CHANGES with the NEW Lightweight 48-inch Aluminum Shell

The greater length of this new shell permits the use of longer drill steels—with 33% fewer steel changes for a given footage. Its lightweight all-aluminum construction cuts shell weight almost in half! In fact, it's even lighter than the old-style 30-inch steel shell and has equal or better life. This light weight is particularly important when drilling from a column or bar.

3

50% MORE DRILLING SPEED when Carset Jackbits are used

These longer-wearing, faster-drilling Carset Jackbits, tipped with tungsten carbide, enable you to take *full advantage* of the potential savings offered by the new I-R drifter combination. Often drilling speeds can be increased by 50% or more, tonnage can be boosted 20% or better and dynamite requirements can be cut as much as 30%. These savings, together with the many other proved advantages of I-R Carset Jackbits, set an all-time high in economy and performance.

THIS COMBINATION *is ideal for use with the famous I-R Drill Jumbo Mounting. For complete information check with your nearest Ingersoll-Rand office today. Let our engineers tell you more about this new cost-cutting combination.*

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N.Y. 499-5

ROCK DRILLS • COMPRESSORS • AIR TOOLS • TURBO-BLOWERS
CONDENSERS • CENTRIFUGAL PUMPS • OIL & GAS ENGINES

CARSET JACKBIT
SET WITH CARBOLOY INSERTS

No clogged drills here
B. F. Goodrich hose has oil-resisting tube

THEY had to move more than 850,000 cubic yards of earth to build the big Bull Shoals Dam in Arkansas. To get the dynamite underground it took more than 42,000 feet of drilling.

Oil sprayed into ordinary air hose rots rubber, causing it to break loose from the tube, clogging up the drill. B. F. Goodrich research engineers worked out a new rubber compound for air hose. It has a high resistance to oil, will not break into loose, gummy particles that clog tools.

On almost any construction job there's plenty of rock, rough roads, cinders that wear down or tear hose covers. B. F. Goodrich air hose has a special tear-resisting cover. Scraping and dragging over rough surfaces won't tear it. Stands hot sun without cracking. Because of its oil-resisting cover, workers with oily hands or gloves can handle it, use it around oily machines.

On jobs where ordinary hose had to be replaced every few weeks to save tools, B. F. Goodrich hose lasted months, even years. This improvement in rubber was made in time to save money and trouble on big jobs like the one pictured here, where B. F. Goodrich air hose is used exclusively, thousands of feet of it.

This is B. F. Goodrich air hose Type 50, recommended for shop tools, tie tamping, portable compressor service, air hoists, ore mining and quarry service. There are many other types of B. F. Goodrich air hose, all being improved and tested through B. F. Goodrich research. If your business uses air pressure, you can benefit from this research, and it costs you no more. First step is to call your local BFG distributor. *The B. F. Goodrich Company, Industrial and General Products Division, Akron, Ohio.*

Air Hose
BY
B.F. Goodrich

ENGINEERING AND MINING JOURNAL

84th YEAR OF PUBLICATION

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GREAT GRADERS

...and here's the proof!

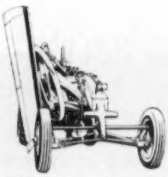
THEY'RE not guessing about the performance of "Cat" Diesel Motor Graders at the Butler Bros. Mining Company, St. Paul, Minnesota. They know from experience these husky yellow machines really pay off around a mine. The better the roads, the faster the hauls and the less damage to trucks—and a "Cat" Grader does a whale of a job on this important task all year round.

Here you see this outfit's "Caterpillar" Diesel No. 12 Motor Grader busy at its South Agnew Mine, Hibbing, Minn. Besides keeping truck haul roads in shape, the No. 12 also 'dozes and levels sand cushion for the mammoth walking dragline. When winter comes, you'll find it busy pushing snow. No slow-down on the job with this hustler at work! Its speed, positive mechanical blading control and in-built stamina all contribute to extra production hours with a minimum of down time. In addition to the No. 12, the company has a flock of "Caterpillar" Diesel Tractors in its fleet. "We have used 'Caterpillar' products in our mines for a long while," says a Superintendent. "We are satisfied they are the best for our pits."

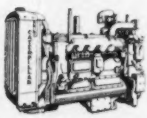
Whatever the grading job, there's a "Cat" Diesel Motor Grader the right size to do it most efficiently and economically for you. And there's a capable, well-equipped "Caterpillar" dealer near-by who's ready round the clock to give you "Johnny-on-the-spot" service. He sincerely believes this rugged yellow machine is the best in the field. Ask him for full proof of its performance!

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

Only "Caterpillar" designs and builds *every* part of the famous "Cat" Motor Graders. This undivided responsibility is your assurance of a long life of efficient, economical performance.

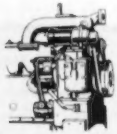


Each of the 3 sizes of "Cat" Motor Graders is a completely different machine. There's no performance penalty due to *excessive frame weight*, too little power or poorly matched working parts.



Only "Caterpillar" Motor Graders have the dependable yellow engines—the power plants that are world famous for delivering 60-minute-hour performance every hour day in and day out.

Lubricating oil is cooled in this radiator section to minimize carbon lacquer and gum formations—enemies of long engine life. Lower temperatures preserve the lubricating qualities of the oil.



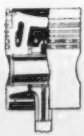
Safe and sure Diesel starts are assured by this electrically started gasoline engine. It warms the coolant and allows the Diesel to circulate "lube" oil before actual starting.

Castings like this cylinder head on "Cat" Diesels are made right in "Caterpillar's" own foundry, where tolerances and quality can be closely controlled—another example of precision engineering!

CATERPILLAR

REG. U. S. PAT. OFF.

ENGINES • TRACTORS • MOTOR GRADERS

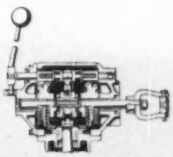


Typical of "Caterpillar" quality are these aluminum alloy pistons. Tops are oil sprayed for coolness and long life. Cast iron compression-ring belt keeps this vital ring working at top efficiency.

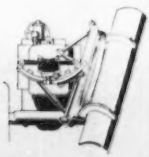
"Caterpillar"-built fuel injection equipment is trouble-free and fool-proof. Injection capsules and pumps can be replaced on the spot in the field — no adjustments are necessary.

Exclusively "Caterpillar," these solid aluminum "con" rod bearings give low rate of wear, ability to carry heavier loads, exceptional heat transfer characteristics and high corrosion resistance.

"Caterpillar" Motor Graders are designed for exceptionally good operator visibility. Sitting down, the operator can see toe and heel of the blade with equal ease. That helps keep jobs moving.



Mechanically operated controls give the user the constant control that is so necessary for precision work. They're quality built — changes in temperature do not affect them.



"Caterpillar's" exclusive side-shift mechanism allows extreme blade positions without the need for manual adjustment of linkage. You'll find this a real work- and time-saver on the job.

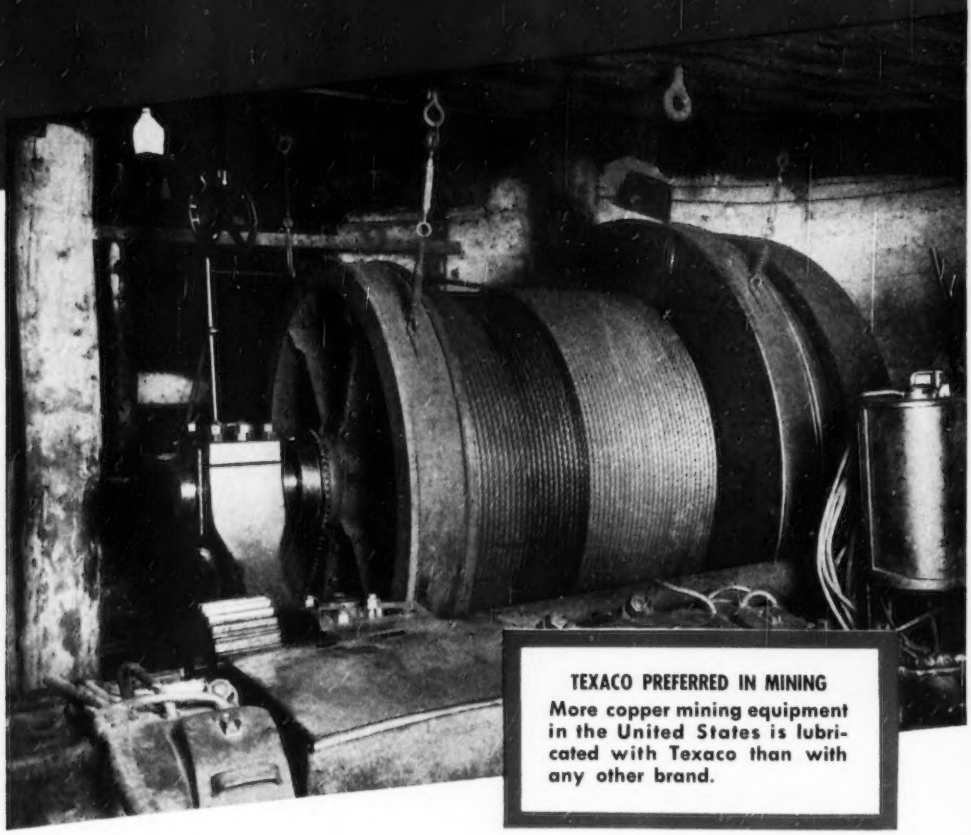
DIESEL

EARTHMOVING EQUIPMENT

Ask your dealer for a demonstration! Ask him for a showing of the new film, "Better Blading"!

KEEP ROPE STRONG...

MAKE GEARS LAST....



TEXACO PREFERRED IN MINING

More copper mining equipment in the United States is lubricated with Texaco than with any other brand.

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on television
every Tuesday night.
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time and station.

TEXACO

TEXACO

LONGER

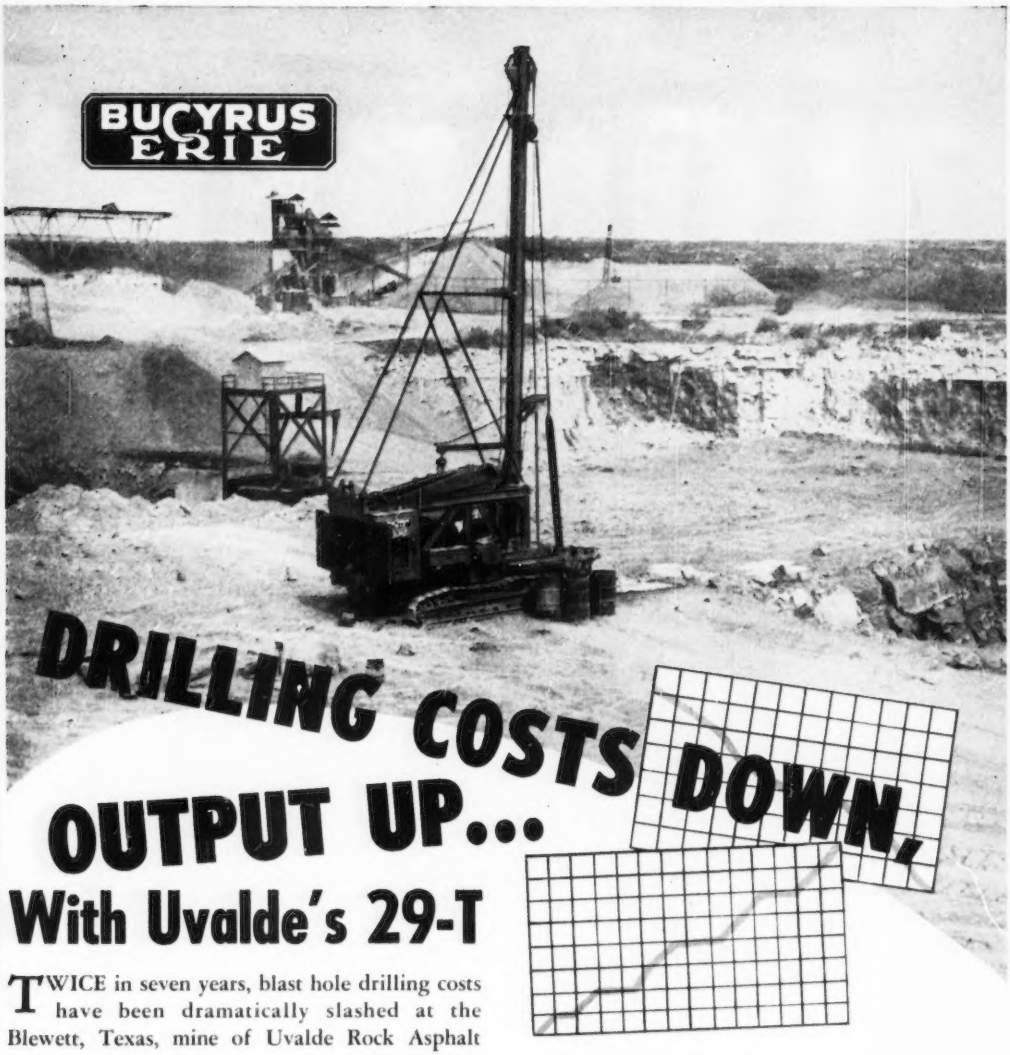
JUST brush or spray *Texaco Crater X Fluid* on your open gears. This is the famous *Texaco Crater* gear lubricant now made fluid for convenient application. It *goes* on as a liquid, *stays* on as a tough, clinging, long-lasting film that carries the load, absorbs the shocks, reduces noise and wear. No heating required, winter or summer.

On your wire rope, use *Texaco Crater A*. It keeps the rope strong longer because, in addition to lubricating the strands, it penetrates and preserves the core, seals out dirt, protects against rust and wear. *Texaco Crater A* is easy to apply and long-lasting.

Lubricate mine car wheel bearings – all types – with *Texaco Olympian Grease*. Your trains will start more easily, run more smoothly. Maintenance costs will come down. *Texaco Olympian Grease* reduces frictional drag . . . lubricates effectively even at low temperatures.

A Texaco Lubrication Engineer will gladly work with you to simplify and improve your maintenance lubrication. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

Lubricants and Fuels
FOR THE MINING INDUSTRY



DRILLING COSTS DOWN, OUTPUT UP...

With Uvalde's 29-T

TWICE in seven years, blast hole drilling costs have been dramatically slashed at the Blewett, Texas, mine of Uvalde Rock Asphalt Company. At the same time, output of high grade processed rock asphalt has risen from 200,000 tons to 500,000 tons per year.

In 1942, Uvalde switched from wagon drills to a new Bucyrus-Erie 22-T. Hole size was increased from 2¾" to 6" and more than doubled in depth. The greater powder capacity and wider pattern with fewer holes enabled Uvalde to cut drilling costs 75%.

Last year, a Bucyrus-Erie 29-T was purchased to put down 10" holes. Drilling costs were cut 50%.

Uvalde has found that: Large diameter holes can be spaced wider apart. Less drill footage is required with fewer holes, less moves and fewer set-ups. Amount of powder per ton of material blasted remains constant. Better powder distribution produces a more uniform fragmentation — less oversize — less need for secondary blasting.

Formerly, two and three crews on wagon drills prepared only 1,000 tons of rock per day. A single 29-T equipped crew drills 600 tons of rock asphalt per hour.

For lower drilling costs, for bigger tonnage, equip *your* mine or quarry with a modern Bucyrus-Erie blast hole drill. 34850

BUCYRUS-ERIE COMPANY
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Only TIMKEN® brings you a complete Rock Bit Engineering Service—with a choice of all three rock bit types!

THIS NEW BOOK TELLS YOU ALL ABOUT IT!

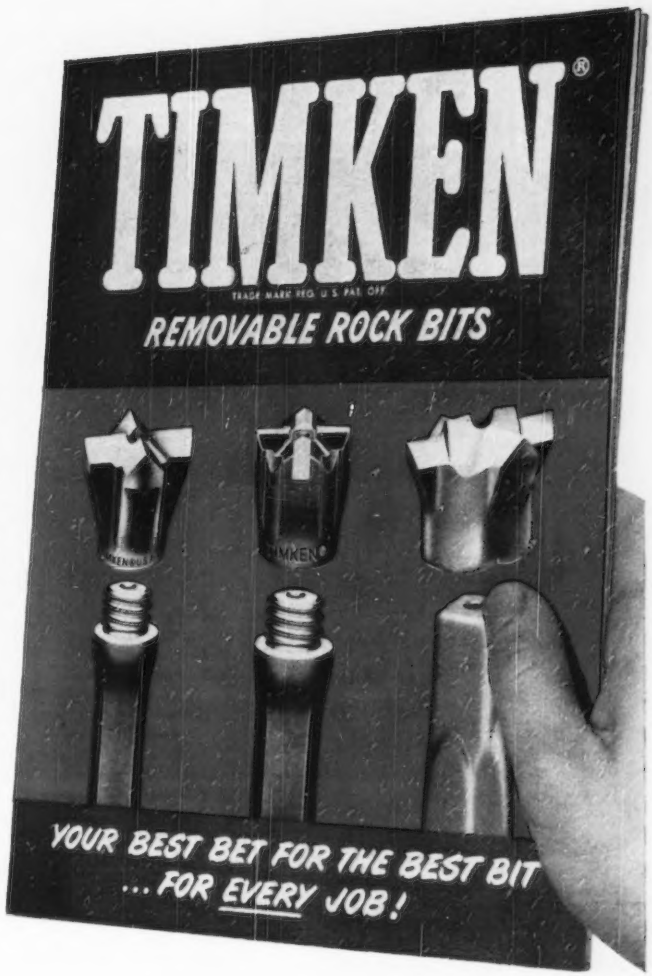
Shows full line of TIMKEN Rock Bits—in actual size

Gives advantages of every type

Tells how TIMKEN'S Rock Bit Engineering Service helps you

ONLY Timken® gives you a *complete* Rock Bit Engineering Service because only Timken makes *all three* types of rock bits! With *all three*—multi-use, carbide insert, and one-use—to draw upon, Timken Rock Bit Engineers can bring you the bit performance your job demands, whether it is lowest bit cost, lowest cost per foot, greatest possible drilling speed, maximum production, or other desired advantages.

Timken's new rock bit catalogue tells you all about the Timken Rock Bit Engineering Service. It describes the full line of Timken rock bits—shows them in actual size—gives complete data on each bit series. Everyone who buys rock bits should have this book. For your free copy of catalogue S-6874 write The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".



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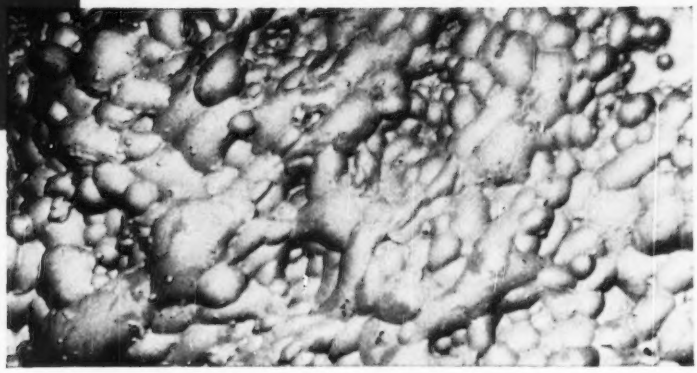
TRADE-MARK REG. U. S. PAT. OFF.

...YOUR BEST BET FOR THE BEST BIT
...FOR EVERY JOB

Dependable Bear Brand Xanthates

"Over Twenty-Five Years' Experience in Producing Xanthates for Metallurgical Use."



BEAR BRAND XANTHATES AVAILABLE

- **Z-3—Potassium Ethyl Xanthate**
- **Z-4—Sodium Ethyl Xanthate**
- **Z-5—Potassium Amyl Xanthate***
- **Z-6—Potassium Pentasol Amyl Xanthate***
- **Z-8—Potassium Sec.-Butyl Xanthate**
- **Z-9—Potassium Isopropyl Xanthate**

*From Sharples Amyl Alcohols

Time and experience have demonstrated that for optimum results in the flotation treatment of substantially all sulphide ores, as well as some oxidized ores and ores containing native metals, Bear Brand Xanthates are the cheapest and most efficient collectors now available.

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THE DOW CHEMICAL COMPANY
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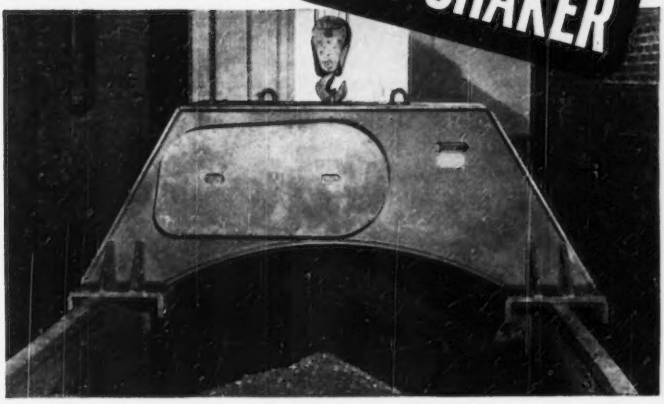
RESPONSIBLE TO INDUSTRY AND AGRICULTURE

CUT ORE UNLOADING COSTS 2 WAYS

ALLIS-CHALMERS CAR SHAKER

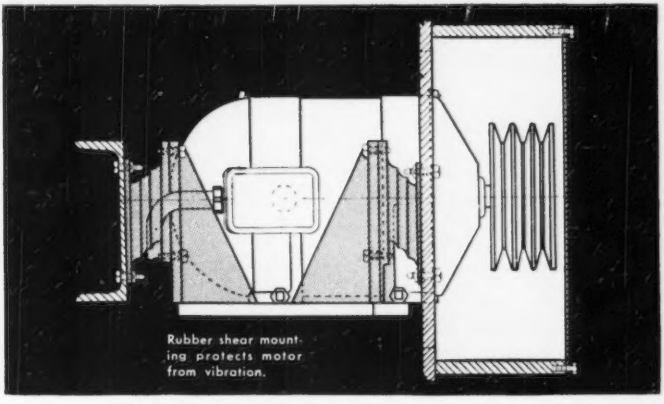
1. SAVE MAN-HOURS

In just a few minutes a hopper-bottom carload of ore can be emptied with the new Allis-Chalmers Car Shaker. Labor is saved at the unloading station. Expensive demurrage costs may be avoided!



2. SAVE MAINTENANCE

Simplified mechanism has minimum of working parts to maintain. Driving motor is 15 hp, high-torque, totally-enclosed... mounted on rubber to protect against vibration! (Note rubber motor mount at right) Steel body is stress-relieved.



HERE'S A CAR SHAKER that is built to withstand severe vibration necessary for fast unloading of bridged and packed ores from hopper-bottom cars.

Its simplified mechanism . . . its unique arrangement for hydraulically removing self-aligning bearings for replacement purposes . . . and *many* other features pay off in low maintenance and long service!

Bulletin 07B7221 gives you more facts. Contact your nearby Allis-Chalmers Sales Office. Or send in the handy coupon.

ALLIS-CHALMERS, 969A SO. 70 ST. MILWAUKEE, WIS.

A-2976

Please send Car Shaker Bulletin 07B7221.

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Title.....

Firm.....

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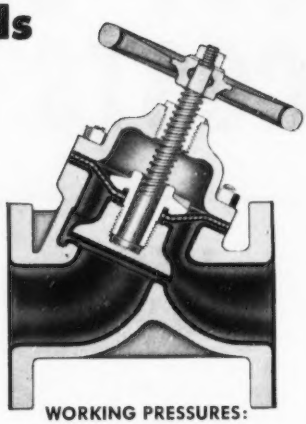
Unique design . . . and choice of materials . . . makes Crane Diaphragm Valves well suited to a variety of mine services. Being packless, they eliminate stem leakage. Their Y-pattern body minimizes resistance to flow. They are easy to operate . . . require less torque and fewer turns . . . to open or close fully.

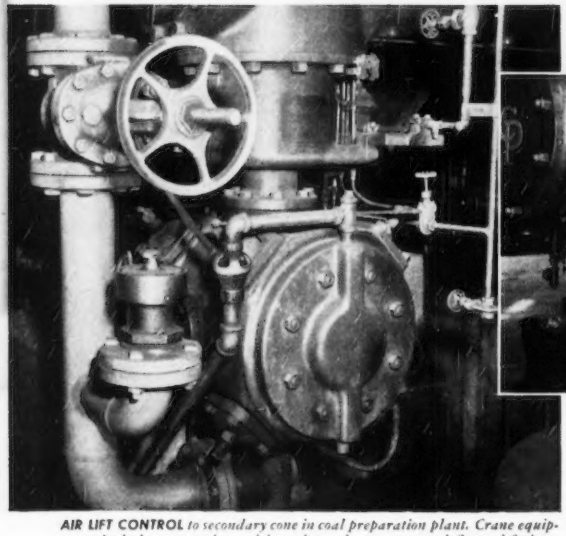
Crane separate disc-diaphragm construction assures safer, more dependable valve performance. Neoprene diaphragm lasts longer because it is used only to seal the bonnet—not for seating purposes. Separate seating disc provides tight closure . . . minimizes loss of fluids even should diaphragm fail.

Crane Diaphragm Valves are Neoprene-lined for conveying corrosive mine waters, sludges, slurries and fluids containing abrasives. Unlined valves are highly suited for compressed air and other common mine services. Send for Circular AD-1761. CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



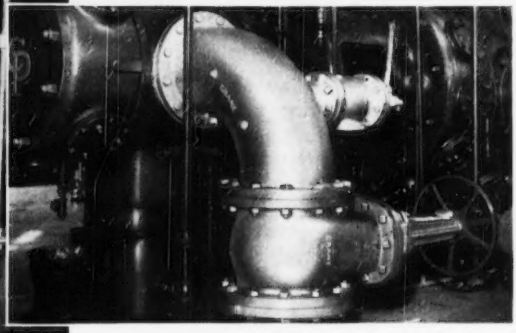
WORKING PRESSURES:
up to 150 pounds water, oil, air, or gas; 180° F. max. temp.
Sizes up to 6-in.
Screwed or Flanged ends

YOU CAN COMPLETELY EQUIP ANY MINE INSTALLATION ON ONE PURCHASE ORDER TO CRANE

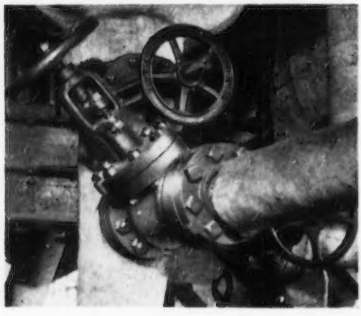


AIR LIFT CONTROL *to secondary cone in coal preparation plant. Crane equipment includes gate valves, globe valves, clamp gates and flanged fittings.*

COMPRESSOR IN COPPER MINE *power house featuring Crane iron body double disc gate valve and flanged fittings.*



LINES TO CLOSED FEED *hot water heater showing Crane 4-in. steel gate valves.*



EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

IF IT'S A REAL ROCK SHOVEL

it means BIG OUTPUT IN ANY DIGGING!

Northwest Rock Shovels have met the *test of Rock.* Their ability in tough digging is proved in literally hundreds of installations. Smooth operations in close quarters, digging force that makes handling the big ones easier, steering that negotiates rough pit floors and benches, ease of control that can be depended on regardless of temperature or weather, assure output day in and day out.

If you are planning on new equipment you should know about Northwest advantages—Uniform Pressure Swing Clutches, the Cushion Clutch, the Northwest Dual Independent Crowd, Differential Steering, the "Feather-Touch" Clutch Control and other Northwest features—and remember, if you have a real Rock Shovel you are sure of *output* in any digging. We'll be glad to tell you more about it now—so you can plan ahead. Make your next shovel a Proved Rock Shovel.

NORTHWEST ENGINEERING COMPANY
1509 Field Building, 135 South LaSalle Street, Chicago 3, Illinois

only the best for the heart of the job

MAKE YOUR KEY MACHINE A NORTHWEST CRAWLER CRANE

PROFIT

NORTHWEST

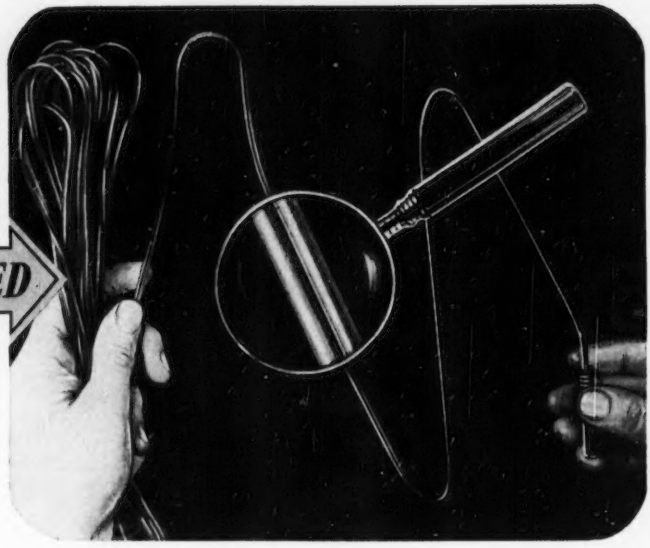
Convertible for any Mining Material Handling or Excavation Problem

Blasters Agree...

The New ATLAS

PLASTIC-INSULATED

Blasting Cap Wiring



Meets The Most Exacting Demands

Here's why:

1. ***It's really tough—and truly waterproof!*** Thick plastic covering, made to withstand rough handling in jagged bore holes. Fully waterproof. Extremely high insulating value.
2. ***Less kinking and snarling!*** With minimum care, it folds or reels out without tangles or kinks—saves time and tempers in hooking up.
3. ***Flexible at 20° below zero!*** Made to withstand Arctic or Tropic weather.
4. ***Easy on eyes and hands!*** No eye-strain to see the brilliant orange or yellow wire, even in dull light. No rough edges when duplex wire is separated into single strands.
5. ***Stands up to rigid tests!*** Compare it with other wire for these outstanding properties; and also for high tensile and compression strength; resistance to deterioration from weather, rodents, vermin.

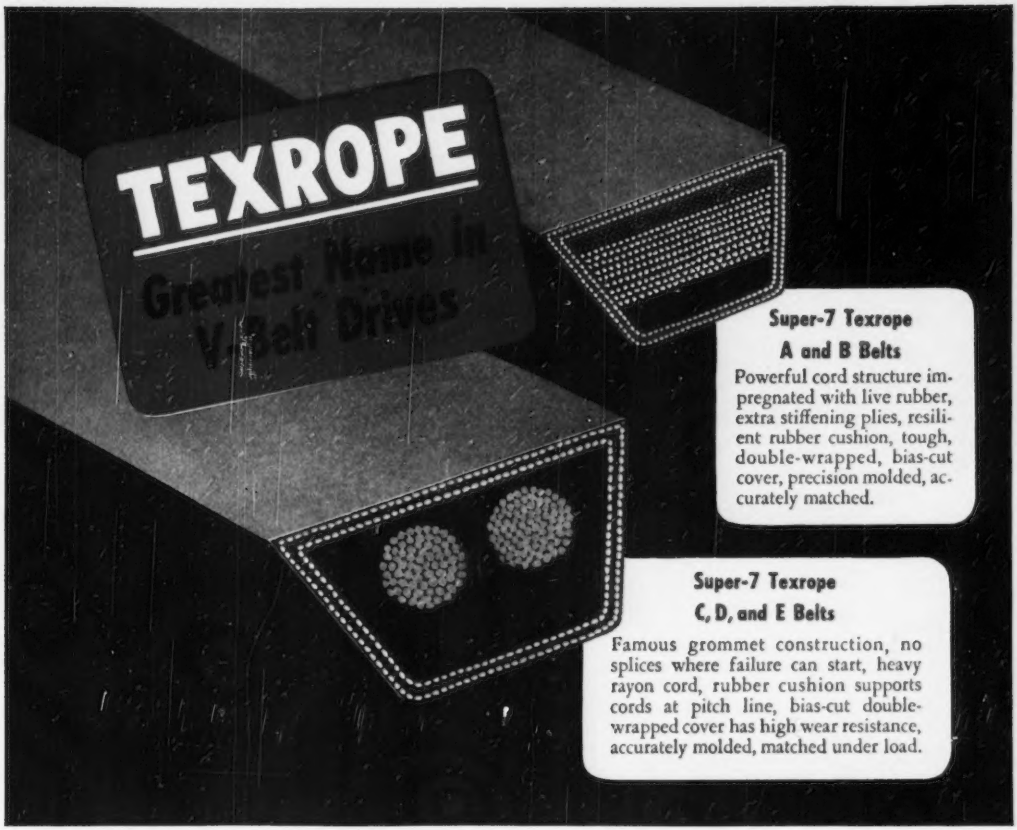
You can save time and trouble—that means *money*—on blasting jobs with the new Atlas plastic-covered leg wires and connecting wiring. This latest Atlas contribution to explosives progress comes up to the highest expectations—and more—of men who use electric blasting caps under the roughest field conditions. Now available in duplex on all Atlas Manasite electric blasting caps with wires 30 feet long or more. Two single plastic-covered wires on shorter lengths. Made by the developers of ROCKMASTER, the original split-second delay blasting system.

ROCKMASTER, MANASITE: Reg. U. S. Pat. Off.

ATLAS EXPLOSIVES *"Everything for Blasting"*

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington 99, Del. • *Offices in principal cities* • *Cable Address—Atpowco*



Super-7 Texrope
A and B Belts

Powerful cord structure impregnated with live rubber, extra stiffening plies, resilient rubber cushion, tough, double-wrapped, bias-cut cover, precision molded, accurately matched.

Super-7 Texrope
C, D, and E Belts

Famous grommet construction, no splices where failure can start, heavy rayon cord, rubber cushion supports cords at pitch line, bias-cut double-wrapped cover has high wear resistance, accurately molded, matched under load.

LONG LIFE FOR YOUR DRIVES

YOU GET MORE than good belts when you standardize on *Super-7 Texrope* V-belts in your plant. You also get the benefit of the greatest V-belt experience in the world. This means you are sure of exactly the right drive for longest life on your job. *Texrope* Drive Department of Allis-Chalmers originated the multiple V-belt drive and there are more *Texrope* multiple V-belt drives in operation than any other make.

High Capacity Belts

These belts have extra strong cords, special rubber cushion and tough neoprene cover to give them 40% greater capacity than standard belts at proportionately higher price. Recommended only for applications where space is limited or other special conditions demand a heavier duty belt. Made in A, B, C, D and E sections.

Complete V-belt Service

Get everything you need for your V-belt drives . . . new and replacement V-belts, standard and variable speed sheaves and speed changers . . . from one reliable source. 144 page *Texrope* Pre-engineered Drive manual covers 90% of requirements. Get your copy today from your A-C Authorized Dealer or Sales Office or write for Bulletin 20B6956.

Texrope and *Super-7* are Allis-Chalmers trademarks. *Super-7 Texrope* V-belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices.

ALLIS-CHALMERS, 969A SO. 70 ST. A-3021
MILWAUKEE, WIS.

Sold . . .
Applied . . .
Serviced . . .

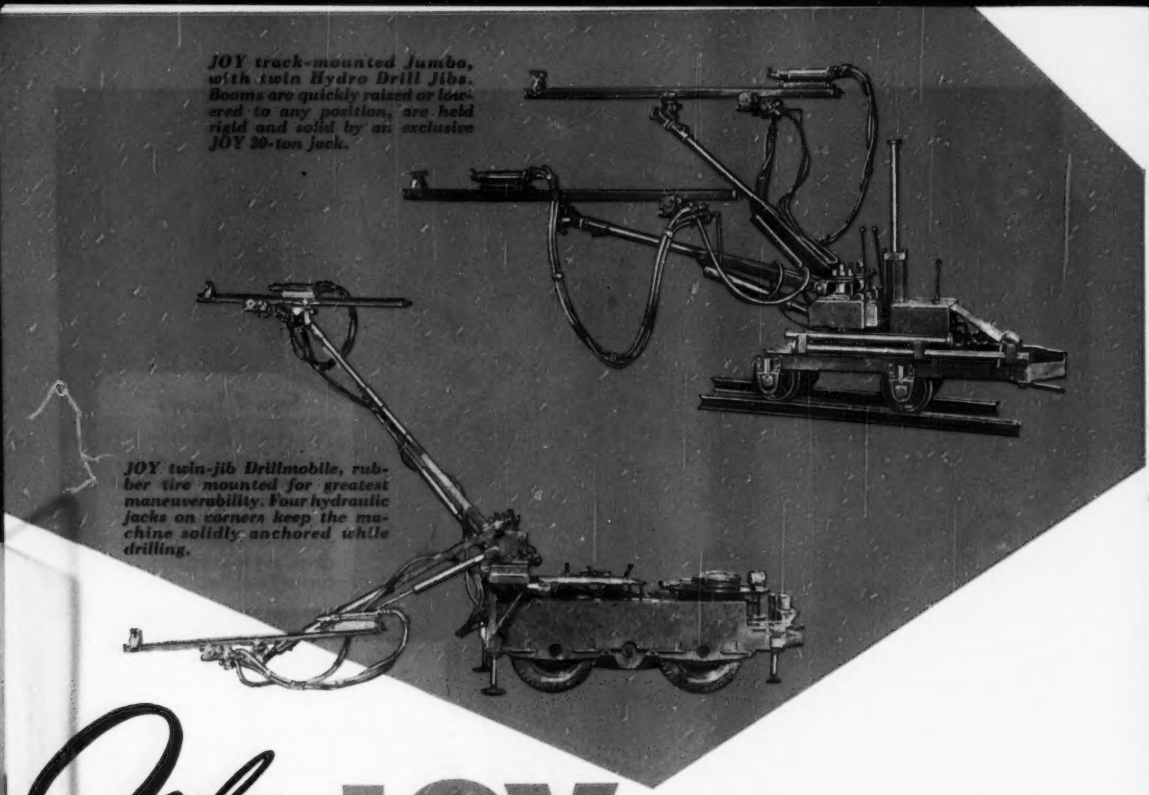
by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS



JOY track-mounted Jumbo, with twin Hydro Drill Jibs. Booms are quickly raised or lowered to any position, are held rigid and solid by an exclusive JOY 20-ton jack.

JOY twin-jib Drillmobile, rubber tire mounted for greatest maneuverability. Four hydraulic jacks on corners keep the machine solidly anchored while drilling.

Only JOY HYDRO DRILL JIBS

give you all these Advantages for FASTER ROUNDS *at* LESS COST

- ★ Long drill feeds—remote control of drills for easy one-man operation
- ★ Complete hydraulic control of jib positioning—pioneered by JOY
- ★ Drill holes more accurately spaced—correct angles more easily maintained
- ★ Greater speed in moving in—setting up—tearing down and moving out . . . no lost time
- ★ Drills holes anywhere in the face—no blind spots
- ★ Greater safety and no back-breaking labor for drill runners —they like it

ABOVE, Twin Hydro Drill Jibs with two JOY T-300 Drifters on a track-mounted Jumbo. Hydraulic control permits fast, easy positioning for any drilling angles. BELOW, a single Hydro Drill Jib model. Remote control and long feeds promote safety.

FOR BEST ALL-AROUND PERFORMANCE WITH JOY HYDRO DRILL JIBS . . .

JOY SILVER-STREAK DRIFTERS

and **JOY SULMET BITS**

Write for Bulletins, or

Consult a Joy Engineer

M243

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

Announcing...

The Amsco® Rever-SharP

The first important reversible dipper tooth improvement made in years!

it's new . . . A reversible, self-sharpening and self-hardening tooth.

it's economical . . . Improves digging efficiency. Lasts longer—with higher resistance to breakage. Tips made of Chromanal; Shanks and Adaptors of Manganese Steel.

FEATURES OF THE AMSCO REVER-SHARP THAT LOWER HANDLING COSTS PER TON

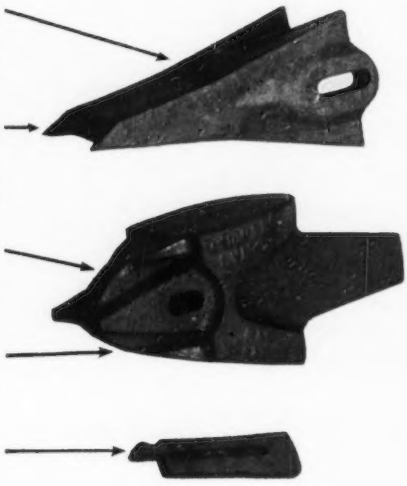
Reversible Tip—Simply turn the tip over when worn. A new, sharp cutting edge is ready for use. Made of Chromanal, the metal that actually work-hardens in service. *The harder you use the Rever-SharP, the harder it gets!*

Unique Cutting Edges—Increase service life and cutting efficiency from 50 to 200%. Reinforced and extended corners take initial impact and work-harden faster; wear is equalized along entire cutting edge.

Special Adaptor—Made of AMSCO Manganese Steel and designed so that extra metal protects base connections and lip from wear. Available to fit all base connections.

Reinforced Nose—Supported along entire length by extended ribs. Protects against bending or breakage. Tip is self-tightening as it is forced against the tapered nose during use.

Trigger Lock-Key—Tapered for easy insertion and removal. Rubber insert prevents loosening in service.



REVER-SHARP ALREADY IN USE—AND SERVICE-PROVED

Acceptance of the Rever-SharP is enthusiastic—*one user reports 6 times the service of former teeth.* Get the complete facts on this new, better dipper tooth. Write today for complete information.

AMERICAN Brake Shoe COMPANY

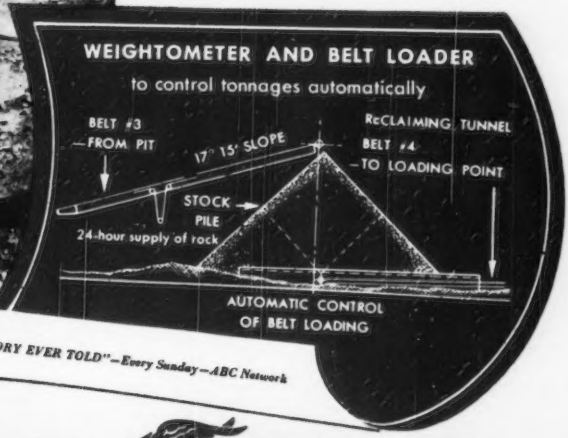
AMERICAN MANGANESE STEEL DIVISION

376 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

These belts outwork 6 trains!

IN a Virginia quarry, a system of four Goodyear conveyor belts—one of which you see here—carries limestone that six donkey-engined trains used to carry laboriously from quarry to plant. The conveyor system, designed by the G.T.M.—Goodyear Technical Man—is ¾-mile long, instead of the six miles of track the railway system used. In addition to short-line haulage, the belts have larger ton-per-hour capacity, making stock piling at the processing end easier. Constant flow ends spotty loading. Haulage costs are far lower, too.

You can consult the G.T.M. on any materials-handling problem by phoning your nearest Goodyear Industrial Rubber Products Distributor, or writing Goodyear, Akron 16, Ohio.



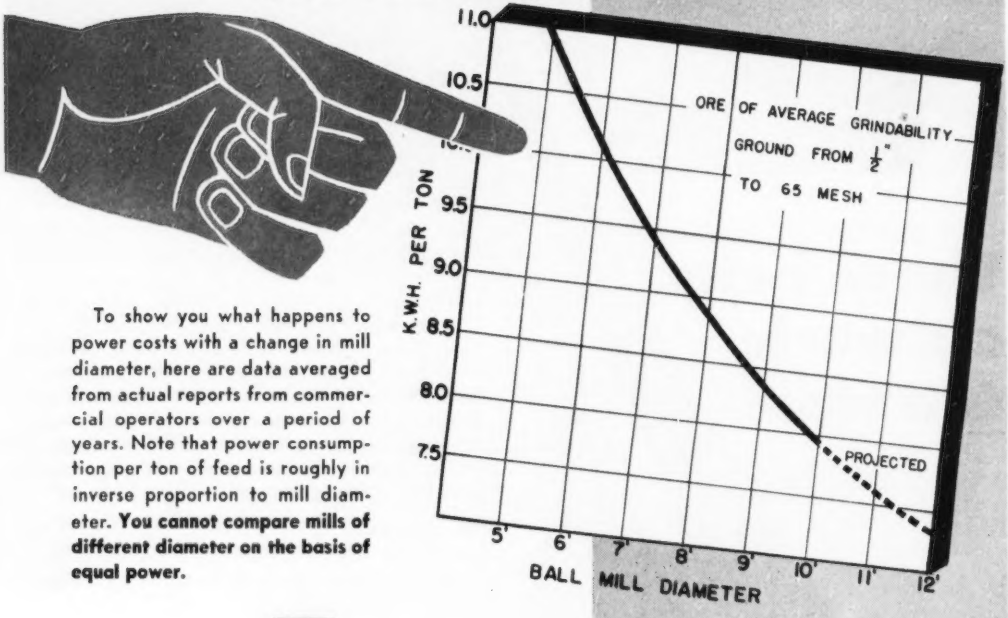
We think you'll like "THE GREATEST STORY EVER TOLD"—Every Sunday—ABC Network

GOODYEAR

THE GREATEST NAME IN RUBBER

HERE'S PROOF...

Power Consumption Varies With Grinding Mill Diameter!



To show you what happens to power costs with a change in mill diameter, here are data averaged from actual reports from commercial operators over a period of years. Note that power consumption per ton of feed is roughly in inverse proportion to mill diameter. **You cannot compare mills of different diameter on the basis of equal power.**

Size for size, MARCY low pulp line ball and rod mills have been proved to have greater capacity than grinding mills of any other type, with corresponding savings in power per ton of finished product and generally better metallurgical results. Ask our engineers to analyze your grinding problems without cost or obligation to you.

OTHER PRODUCTS

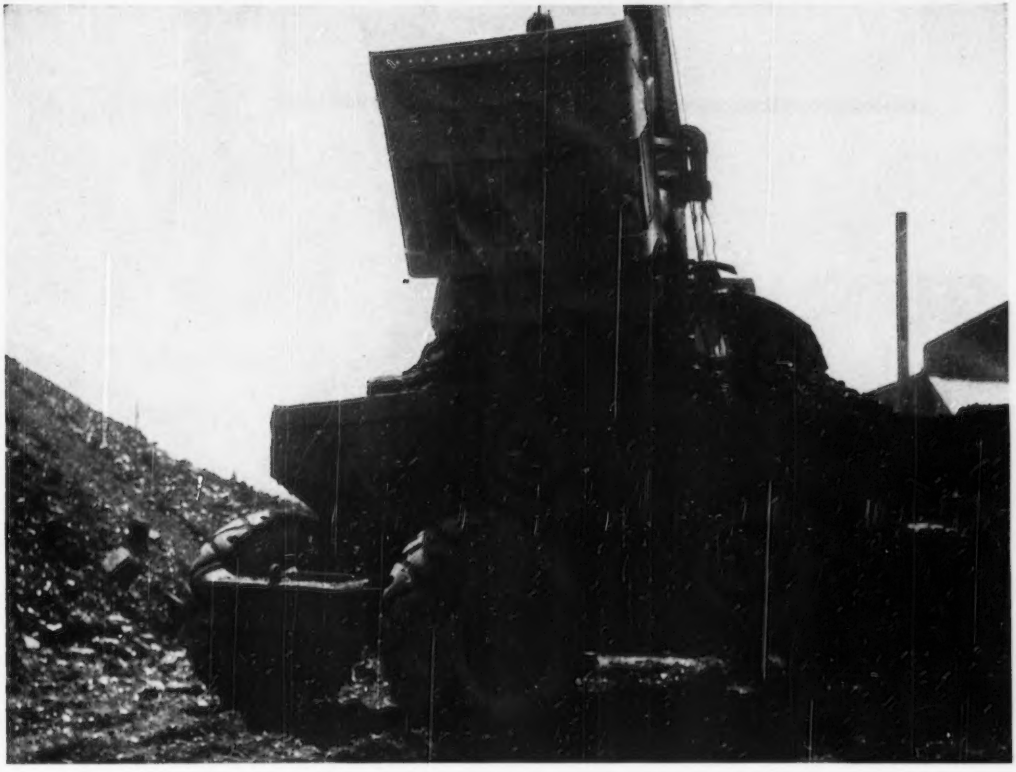
Massco Fahrenwald Flotation Machines; Genuine Wilfley Tables; Massco-McCarthy Hot Millers; Rock Bit Grinders; Density Controllers; Belt Feeders; Pinch Valves; Assay and Laboratory Supplies and Equipment; Complete Milling Plants; Constam Ski Lifts.

THE Mine & Smelter SUPPLY COMPANY

Main Office: DENVER, COLO., U.S.A.; El Paso; Salt Lake City; 1775 Broadway, New York, N.Y.

Representatives: Canadian Vickers, Ltd., Montreal; W. R. Judson, Santiago and Lima; The Edward J. Nell Co., Manila, P. I.; The Ore & Chemical Co., 80 Broad St., New York 4, N.Y., for Continental Europe.

B.F.Goodrich



ALL-NYLON tire record:

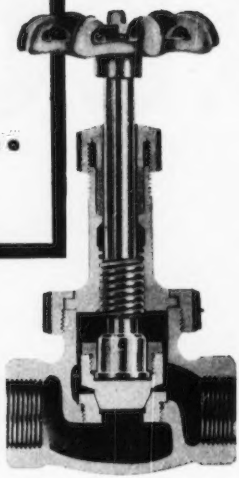
no blowouts, no bruise breaks, no flex breaks!

THE B. F. Goodrich ALL-NYLON tire is proving successful in mining operations all over the country. The record speaks for itself — up to now no blowouts, no bruise breaks, no flex breaks! And that includes severe operating conditions in mines where flex and bruise failures formerly were common.

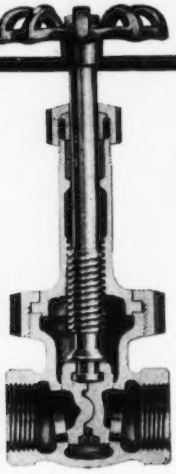
Along with nylon, BFG uses weftless construction; no cross-threads in tire plies to hamper cord action and allow some cords to stretch out. Therefore, tire growth is reduced—tires last longer. Where tire costs are high because of blowouts, flex breaks and bruise breaks, B. F. Goodrich all-nylon tires can make definite savings.

The new, all-nylon construction (used in the *Universal* and *Rock-Logger* tires shown at right) is typical of the continuous improvements being made in tires by B. F. Goodrich. Long ago, BFG engineers developed special types of tires for mining service. For more information on the way B. F. Goodrich tires can do more work and save you money, call your BFG dealer — or write directly to *The B. F. Goodrich Company, Akron, Ohio.*

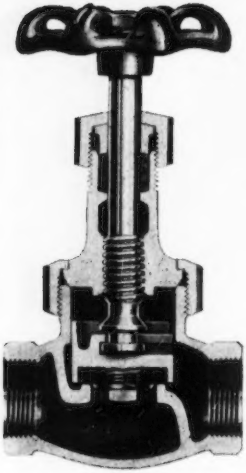
Walworth bronze valves...



Walworth No. 225P Globe Valve
500 Brinell Seat and Disc



Walworth
No. 29 Gate Valve



Walworth No. 95 Globe Valve
Re-New-Disc

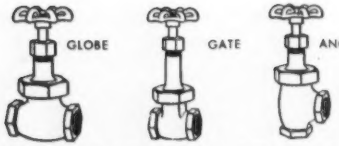
built to give dependable trouble-free service on all recommended jobs

Walworth No. 95 Bronze Globe Valves (Angle Type: No. 96) are recommended for service where throttling is not required. They are rated at 150 psi working steam pressure, 500F; 300 psi cold water, oil or gas. The improved renewable disc and lock-on, slip-off disc holder — an original Walworth development—saves time and trouble. This valve can be repacked under pressure when fully opened. All parts are designed to give maximum service and strength.

Walworth No. 29 Bronze Gate Valves are rated at 200 psi working steam pressure, 550F; 400 psi cold water, oil and gas. These valves have rising stems and integral seats. Sizes 2-inch and smaller have union bonnets; sizes 2½ and 3-inch have bolted bonnets. Valves up to and including ¾-inch have solid wedge discs; 1-inch and larger have split wedge discs. These valves can be repacked under pressure when fully opened.

Walworth No. 225P Bronze Globe Valves (Angle Type: No. 227P) are rated at 350 psi working steam pressure, 550F; and 1000 psi non-shock service on cold water, oil and gas. The stainless steel, plug type seat and disc — heat treated to 500 Brinell — can be closed on sand, slag, scale and similar floatage, without injury to the seating surfaces. They are the longest wearing, TOUGHEST bronze valves you can buy.

For full information about Walworth Quality Bronze Valves, see your Walworth distributor, or write:



WALWORTH
valves and fittings
60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Fit Thermoid Quality and Experience into Your Belting Picture

Thermoid high quality stems from continuing research and product development. To complete this picture, your Thermoid distributor and the Thermoid field representative, working as a team, offer you practical experience in solving your particular problem.

Whether it's run-of-the-mill or something "special", your Thermoid distributor can help you select the right Thermoid Conveyor Belt. And the down-to-earth advice of Thermoid field representatives is welcomed by men faced with belting trouble in mining, quarrying and construction operations. They know this advice is the result of day-by-day experience with conditions *in the field.*

It Will Pay You to *Specify* Thermoid

If your belting fails prematurely—if you're stumped with a tough belting problem—call your Thermoid distributor. Together with the Thermoid field representative, he can help you get greater economy, efficiency and tonnage for your belting dollar.

Thermoid Quality Products: Transmission Belting • F.H.P. and Multiple V-Belts • Conveyor Belting • Elevator Belting • Wrapped and Molded Hose • Molded Products • Industrial Brake Linings and Friction Materials.

Thermoid Company

Main Offices and Factory • Trenton, N. J., U. S. A.
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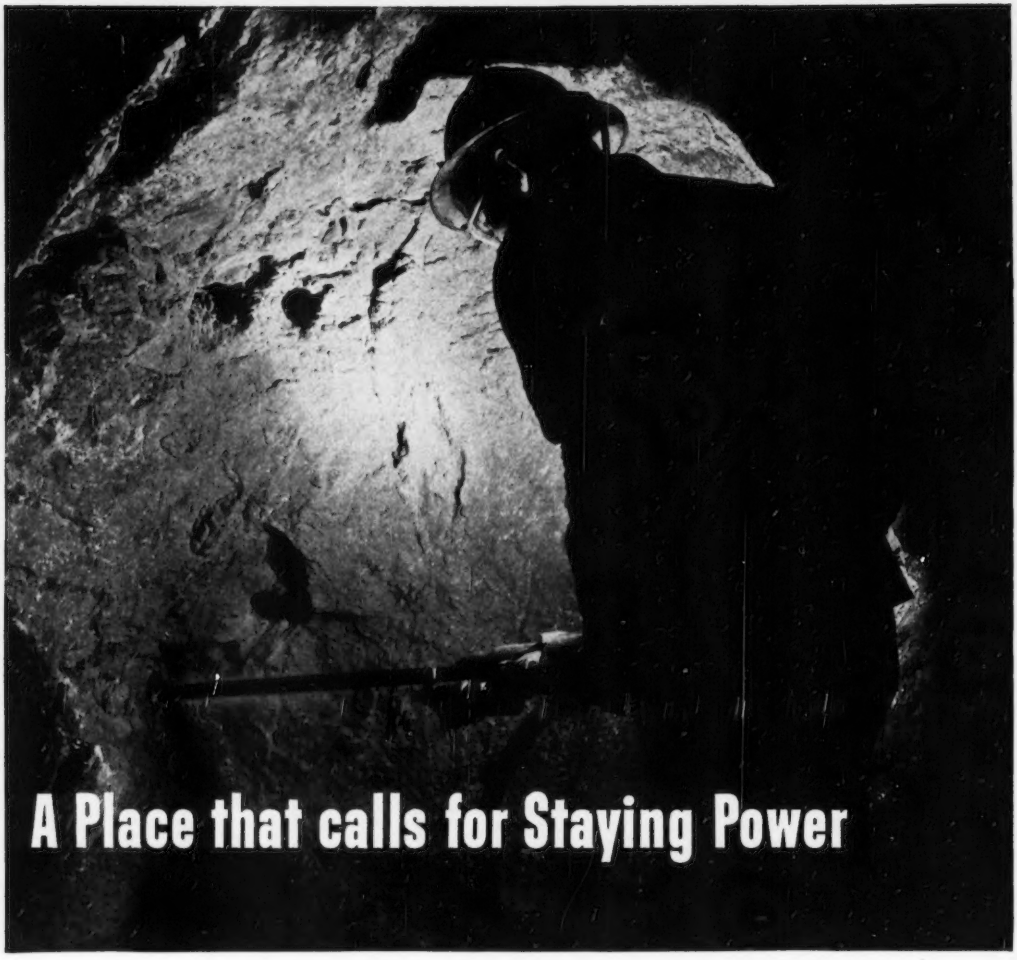
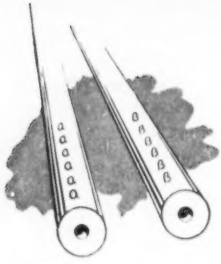
Industrial Rubber Products • Friction Materials • Oil Field Products



A Place that calls for Staying Power



Look for the marks of fine steel. Bethlehem carbon drill steel is marked "B"; alloy drill steel is identified by "A". These smooth letters are rolled in groups of six at 30-in. intervals.

Service underground in a mine calls for lots of staying power. Consider drill steel, for example. This mining tool was indispensable long before high-speed rock drills came into use. Drill steel seldom rates more than routine attention around a mine. But the way it does its job has plenty to do with drilling efficiency.

Taking drill steel for granted can be costly. It's better to specify Bethlehem Hollow. Then you'll have a top-quality steel with the staying power that drill runners can rely on. Its tough, fatigue-resisting qualities have earned it the name, "Old Reliable."

All the Features You Need • **Ideal for either forged or detachable bits • Smooth center hole minimizes fatigue failure • Wide quenching range for easy heat-treating • Controlled hardenability for top performance • Rigidly inspected for quality and uniformity**

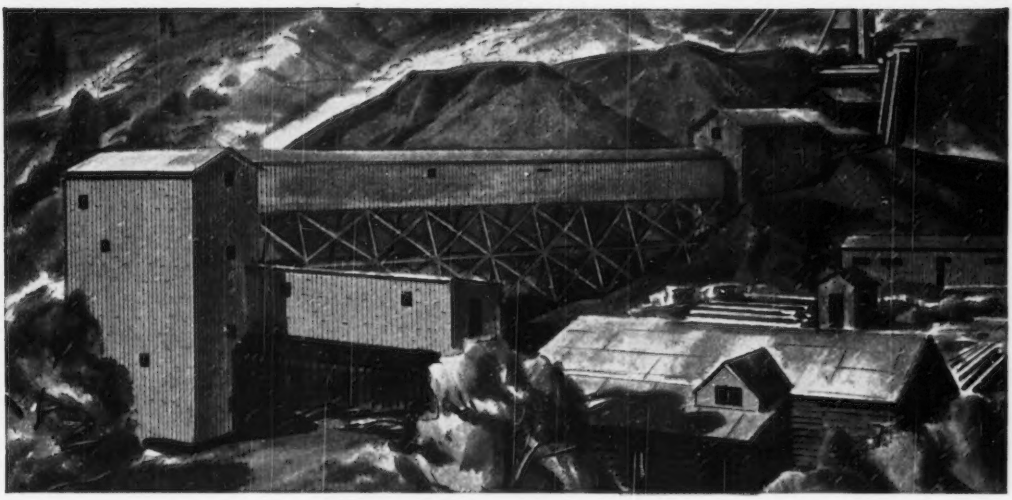
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM HOLLOW DRILL STEEL



For Wood Construction that has to last!

Use penta-chlorophenol treated wood

Wood weakening decay is a major cause of replacement in most mines. Wise operators reduce this cost to a minimum by specifying "PENTA"-treated timbers and ties, and other wood construction.

- PENTA-protection is *long lasting*—will not leach out.
- PENTA-protection is *dependable*—it's always the same.
- PENTA-protection is *clean*—easy to work with.
- PENTA-protection is *economical*—ties and timbers last 2 to 4 times longer.

For additional information about PENTAchlorophenol, write Dow, Dept. PE 29.

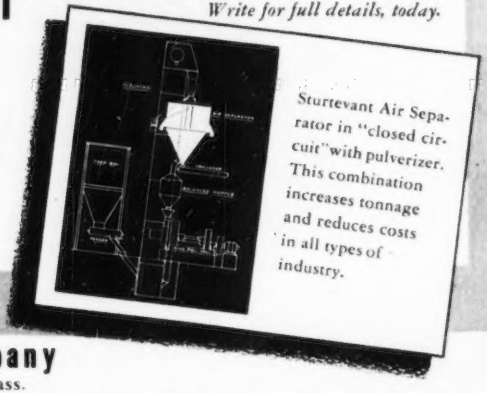
THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

DOW
penta-
chlorophenol

Here's How STURTEVANT Air Separators Increase Production of Fines... Lower Separation Costs

- Sturtevant Air Separators effect production savings by increasing output by 25 to 300%... reducing power consumption by as much as 50%.
- They efficiently carry off all classified materials in any desired fineness from 40 to 325 mesh and finer... eliminate the need of screening in certain applications.
- Capacities available from ¼ to 50 tons per hr.

Write for full details, today.



Sturtevant Air Separator in "closed circuit" with pulverizer. This combination increases tonnage and reduces costs in all types of industry.

Sturtevant Mill Company

101-A Clayton Street, Boston 22, Mass.

Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT Calol O.H.T. Grease

UNIT Automotive generator bearing

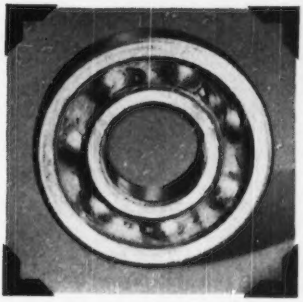
LUBRICATOR Sealed at installation

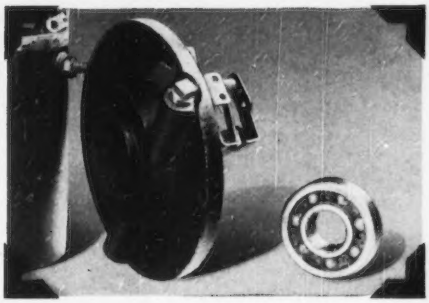
CONDITIONS Heavy-duty diesel truck engine

MILEAGE 70,000

FIRM H. G. Makelim Co., San Francisco–Oakland

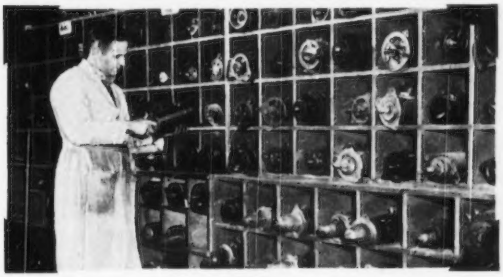
Sealed generator bearing still perfect after 70,000 miles!





ONE APPLICATION OF CALOL O.H.T. GREASE, sealed in the bearings when this diesel-engine generator was assembled by H. G. Makelim Co., prevented any bearing wear in 70,000 miles of heavy-duty truck service. Generator was disassembled at this time only because it needed new brushes, and for general inspection. Note a permanent plug replaces usual grease fitting.

70,000 MILES OF SERVICE did not affect or use up any of the CALOL O.H.T. Grease in the bearings. In special tests, one filling has lubricated bus-generator bearings perfectly for more than 150,000 miles.

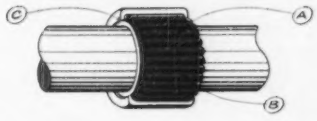


"WITH CALOL O.H.T. GREASE SEALED IN BEARINGS, we recommend installing generators without grease fittings," says Frank Balzarini, H. G. Makelim Co. Foreman. "CALOL O.H.T. eliminates need for greasing between overhauls. And eliminating fittings stops over-greasing—a big cause of wear and trouble."

REMARKS: The H. G. Makelim Magneto Repair Company, San Francisco and Oakland, one of the West's oldest automotive-electrical and carburetor repair firms, specializes in servicing equipment in the toughest automotive service—truck, bus and car fleets.

Besides generator bearings in this service, CALOL O.H.T. Grease is recommended for all types of plain and anti-friction bearings in service under extremely severe operating conditions.

How CALOL O. H. T. Grease protects bearings in severest operating conditions



Used in any type of bearing under any operating condition, high temperature-low speed, high speeds to 10,000 rpm, temperatures from minus 10° F. to 400° F., CALOL O.H.T. Grease will last indefinitely.

A. Contains special oxidation inhibitor—prevents rusting, corrosion, hardening of grease at any time.

B. Resists high temperatures — eliminates coking and formation of deposits.

C. Provides excellent seal against water... lubricates efficiently in slight moisture.

CALOL

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

Trademark "CALOL" Reg. U. S. Pat. Off.

STANDARD OIL COMPANY OF CALIFORNIA • San Francisco
THE CALIFORNIA OIL COMPANY • Barber, N. J., Chicago
STANDARD OIL COMPANY OF TEXAS • El Paso, Texas
THE CALIFORNIA COMPANY • Denver, Colorado

FOR RUGGED DIGGING STRENGTH

FOR BIG YARDAGE OUTPUT...

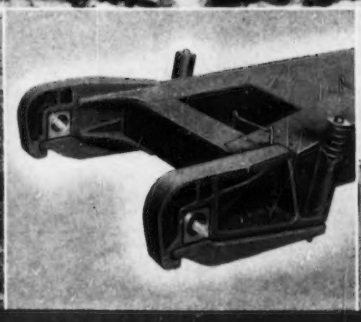
Steady production day in, day out, on your toughest excavating work, you can't afford to overlook the many cost-cutting advantages of this rugged, heavy-duty Koehring 605 shovel.

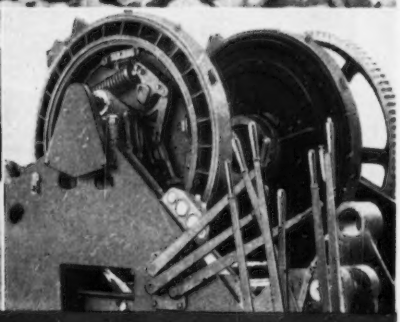
Heavy-duty rock boom of rigid box design is extra deep below shipper shaft, withstands the digging twists and strains of heaviest shovel work. Shipper shaft mounted on top gives still greater strength in the deep mid-section. Heavy steel rubbing plates protect boom against wear from dipper sticks. Boom foot is massive, wide . . . provides a solid base for heavy-duty digging.

Shock-absorbing boom mount . . . fast operating speeds . . . big 1½-yard dipper . . . power-operated clutches, all help keep production high, costs low. Check, too, how this 605's compact, accessible machinery arrangement simplifies adjustments, lowers maintenance costs, and increases work-time. For complete facts, see your Koehring distributor. Other Koehring heavy-duty sizes: 2½-Yd. 1005, ¾-Yd. 304, ½-Yd. 205.

Also, send for catalog on 2½-yard 1005

KOEHRING HEAVY DUTY

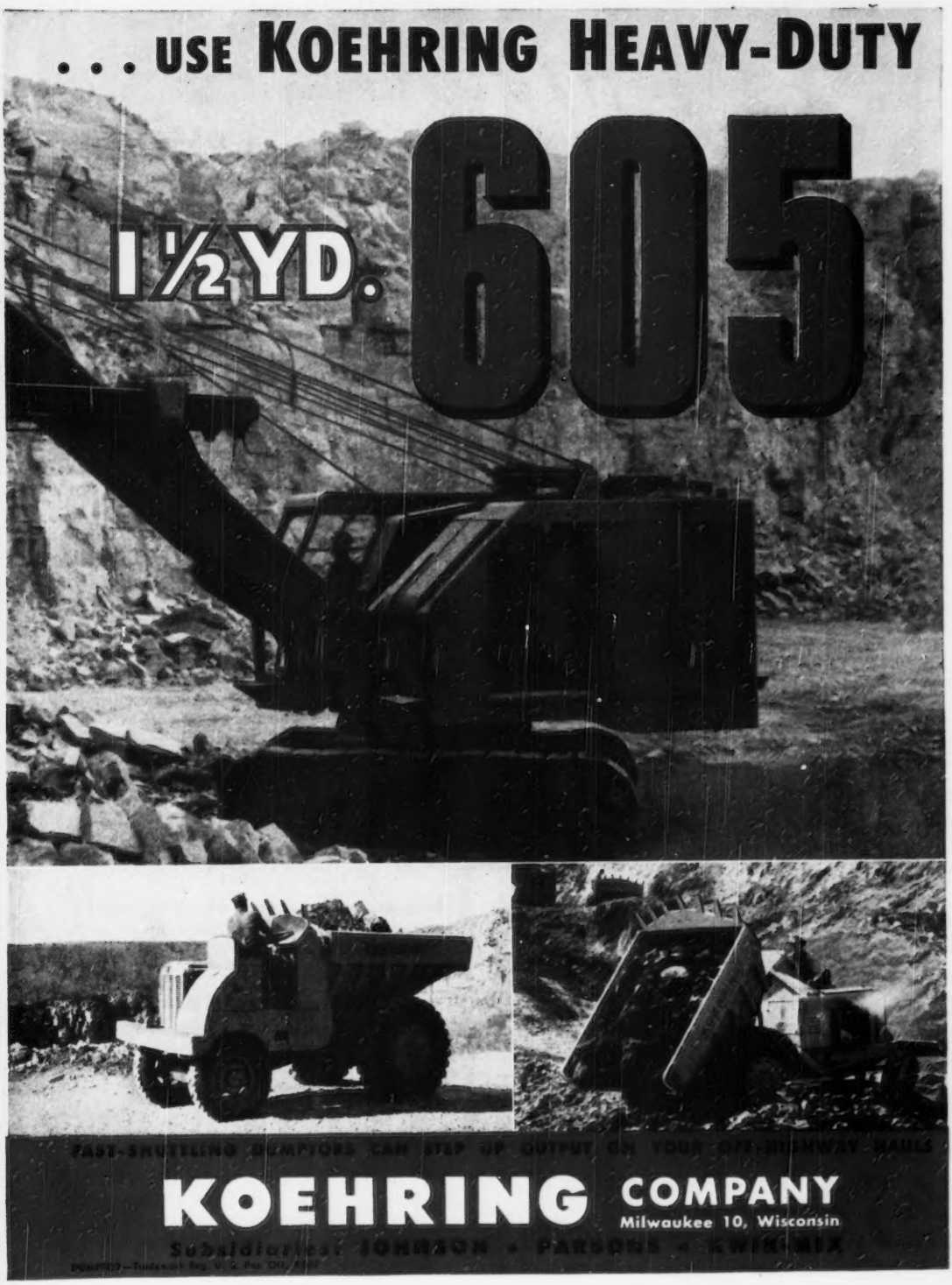




HEAVY-DUTY DIPPER is built for long-lasting service in the toughest digging . . . has manganese lip, reversible teeth, big pins, manganese bushings . . . is all welded for extra strength, less deadweight and bigger payload.

"BOOM-GUARD" SHOCK ABSORBERS: Heavy coil springs, one on each side of boom foot, cushion jars of fast rock handling . . . protect entire shovel attachment, without sacrificing rigidity. Easier on the machine, easier on the operator.

1/10th NORMAL LEVER PULL . . . Koehring power clutch does the heavy work . . . supplies 90% of the effort when operator sets this big 37" clutch. Average 7 lb. lever pull reduces operator fatigue, yet retains "feel" of load.


. . . USE KOEHRING HEAVY-DUTY
1½ YD. 605
FAST-SHUTTLING DUMPTORS CAN STEP UP OUTPUT ON YOUR OFF-HIGHWAY HAULS
KOEHRING COMPANY
Milwaukee 10, Wisconsin
Subsidiaries: JOHNSON • PARSONS • KWIK-MIX

Service...

your interests of first importance—

There are **2** *ways of doing your diamond drilling*

One is to do it yourself.
The other is to contract it.

Doubtless you ask yourself "which is the better way for me?" The decision, of course, rests with you, but first consider how your own best interests will be served by contracting your drilling to Longyear. Here are some of the specific advantages:

1. Your job is studied from your viewpoint, and the objectives to be accomplished. Your interests are of first importance.

2. The right drill for efficient work will be selected for your job. This saves you an investment in equipment.

3. Experienced drill crews carry on under competent direction. They are resourceful in handling complex drilling problems. Competency saves you money, because delays due to inexperienced operators are eliminated.

4. Longyear improved coring equipment gives you the best core recovery possible in any given formation . . . *CORES TELL THE STORY.*

Decide to have Longyear demonstrate the above advantages on your job. Our Contract Drilling Division will respond to your call.

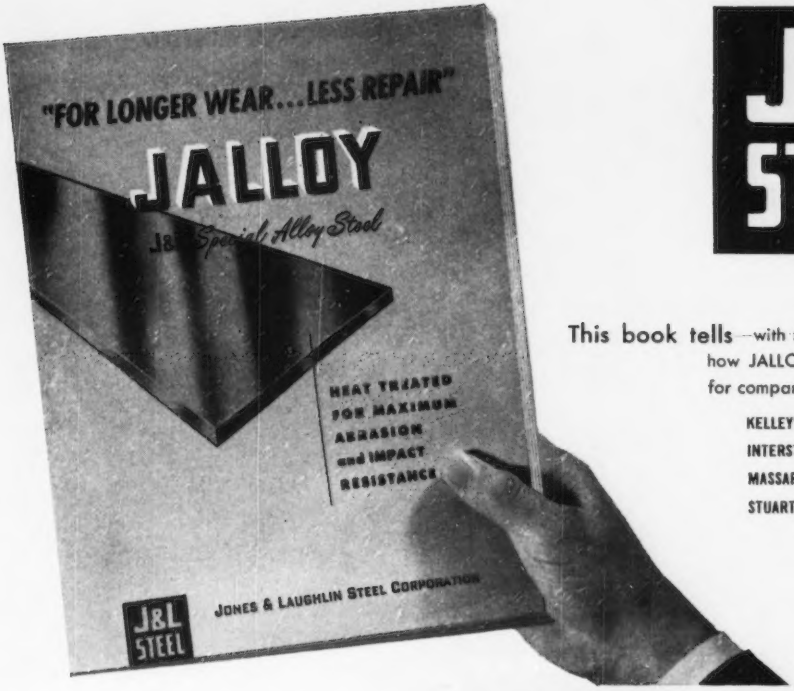
E. J. LONGYEAR COMPANY

MINNEAPOLIS, MINNESOTA, U.S.A. NEW YORK OFFICE, 1775 BROADWAY

CANADIAN LONGYEAR, LIMITED, NORTH BAY, ONTARIO, CANADA

DIAMOND CORE DRILLS • CONTRACT CORE DRILLING
SHAFT SINKING • GEOLOGICAL INVESTIGATIONS

REPRESENTATIVES IN PRINCIPAL MINING CENTERS IN THE UNITED STATES AND OTHER COUNTRIES


"FOR LONGER WEAR... LESS REPAIR"
JALLOY
J&L Special Alloy Steel
HEAT TREATED FOR MAXIMUM ABRASION and IMPACT RESISTANCE
J&L STEEL
JONES & LAUGHLIN STEEL CORPORATION

J&L STEEL

This book tells—with *facts and figures*—just how JALLOY Steel saves money for companies like these:

KELLEY'S CREEK COLLIERY CO.
INTERSTATE IRON CO.
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Learn how others SAVE MONEY with J&L JALLOY Steel

Is abrasion eating up YOUR PROFITS?

JALLOY heat-treated plate is the steel that is saving users' money through *longer wear . . . less repair.* Every design engineer, operating man and maintenance superintendent should have a copy of this 36-page, illustrated book that shows how much longer JALLOY Steel lasts where abrasion and impact limits the life of equipment. The coupon at the right may help you change losses into profits.

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Without obligation, send me a FREE copy of "JALLOY—J&L Special Alloy Steel," the book that tells how I can reduce maintenance cost through *longer wear . . . less repair.*

NAME_____ TITLE_____

COMPANY_____

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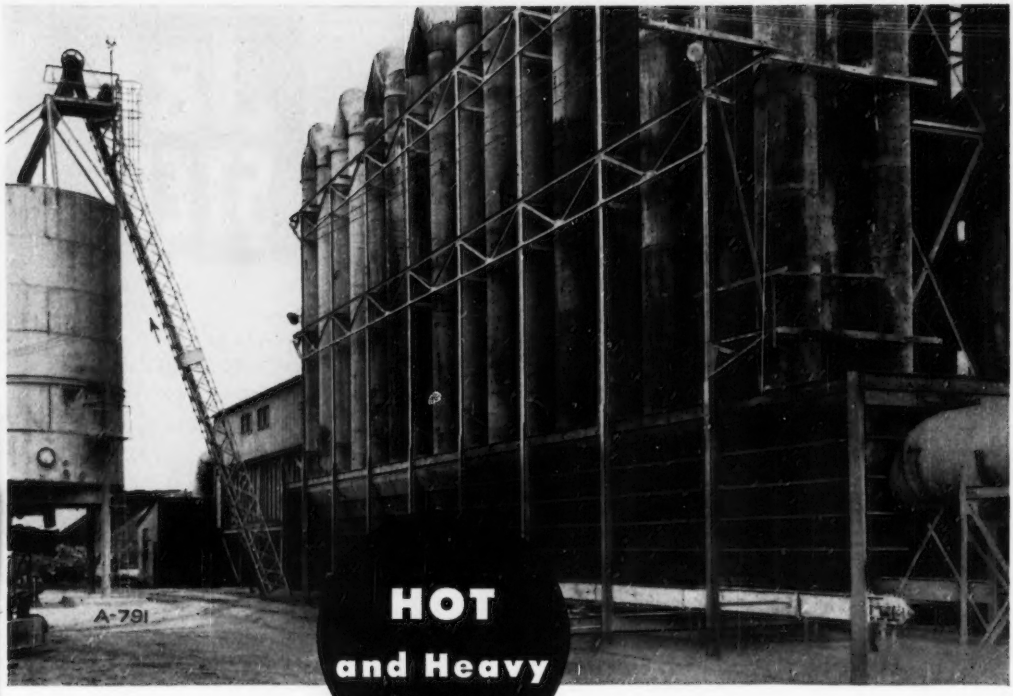
MAIL IT TODAY!



HOT and Heavy

S-A Bulk Handling System

Mechanizes Hot Slag Reclamation—Stockpile to Storage

The right equipment to handle each stage of processing zinc oxide from hot slag, in this case includes water-cooled REDLER Conveyors, enclosed to prevent spillage and contamination. The compact, fully mechanized S-A installation was designed and installed to handle every conveying operation from stockpile . . . through processing . . . to final storage of finished zinc oxide.

Applications such as this one . . . that call for bulk materials handling equipment of many different types . . . engineered to perform various conveying functions . . . have been successfully completed by S-A engineers for almost half a century. Whatever the bulk material may be, S-A engineers can develop a system to handle the most tons at lowest cost per ton.

You too can draw on the vast experience of these S-A engineers. Simply ask for their recommendations. . . . they'll cost you nothing, so write today.

Slag, from stockpile, is dumped into hopper fitted with grizzly screen from which S-A belt feeder draws it for movement into scale house. Inclined belt conveyor and bucket elevator take it to storage bins. From storage through processing other S-A units handle slag. Very hot materials are conveyed in water cooled REDLER Casings which also prevent spillage and contamination. Finished zinc oxide collects in hoppers under cooling towers and is drawn out by REDLER Conveyors. A 60' high REDLER elevator places finished product in storage tank ready for shipment.

STEPHEN S-A DAMSON MFG. CO.

4 Ridgeway Avenue, Aurora, Illinois · Los Angeles, Calif. · Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

WICKWIRE ROPE

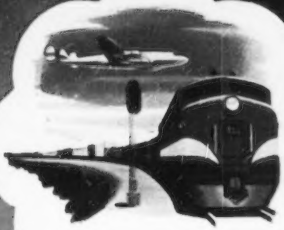
A PRODUCT OF CF&I

Ask any user . . . you'll find them everywhere

In scores of industries, users of Wickwire Rope have developed an affectionate respect for its performance, safety and long life. And, for true economy, they use Wickwire's WISSCOLAY® Preformed. It lasts longer—is easier to cut, splice and install. It's kink-resistant and safer to handle. Wickwire Distributors and Rope Engineers, in key cities everywhere, are prepared to render prompt service in meeting your wire rope needs. Wickwire Rope Sales Office and Plant—Palmer, Mass.

IN THE EAST—Wickwire Spencer Steel Div. of C. F. & I.
500 5th Ave., New York 18, N. Y.
IN THE ROCKIES—The Colorado Fuel and Iron Corp.
Continental Oil Bldg., Denver, Colo.
ON THE WEST COAST—The Colorado Wire Cloth Corp.
2040—17th Ave., Oakland 6, Cal.

LOGGING

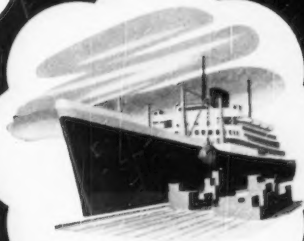


TRANSPORTATION

MINING

PETROLEUM

MANUFACTURING



MARINE

CONSTRUCTION

A. E. Brainard

YEARS FASTER...

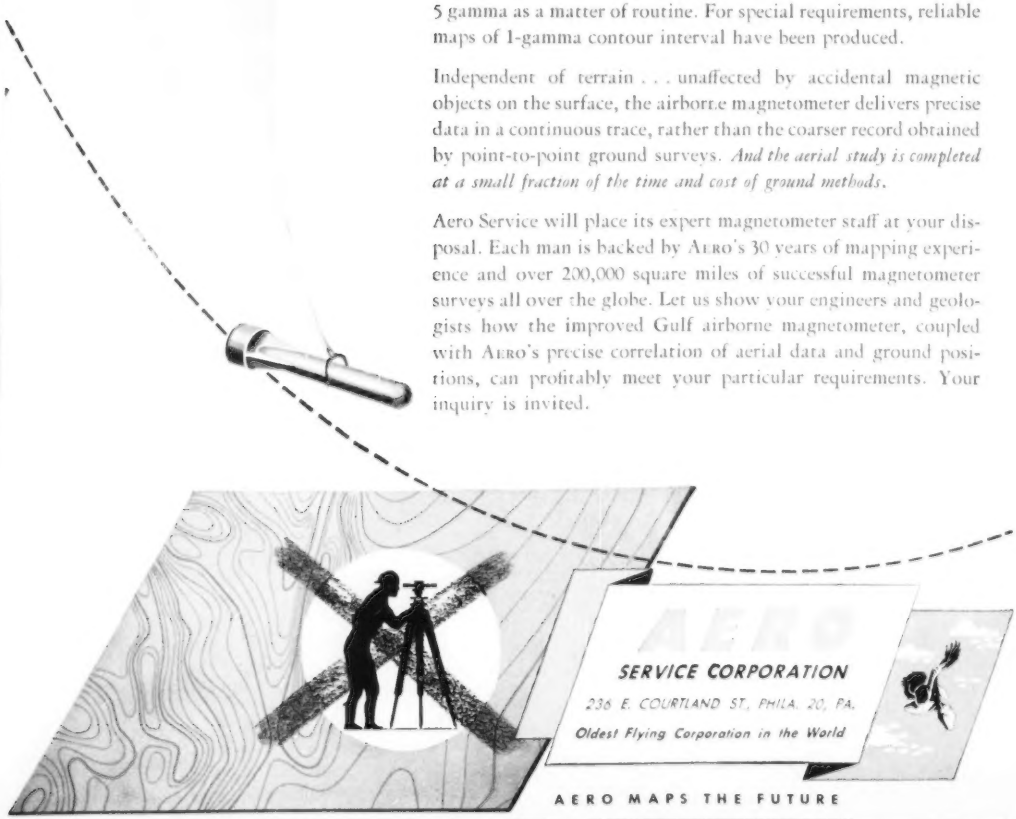
with the new, improved airborne magnetometer

Ground surveys are slow moving and costly. In the race to locate new sources of minerals, accurate geophysical data must be collected swiftly and economically. For this important function, the new, improved Gulf airborne magnetometer is now available to the mining industry.

Developed by Gulf and field tested by Aero Service, the improved magnetometer brings a new precision to the aerial magnetic method. It is essentially drift-free—capable of a much more rapid response. As a result of this increased stability and sensitivity, an exact magnetic record, accurate to variations of only 1 gamma, can be made. From these records, AERO technicians compile precision magnetic intensity maps contoured to intervals as small as 5 gamma as a matter of routine. For special requirements, reliable maps of 1-gamma contour interval have been produced.

Independent of terrain . . . unaffected by accidental magnetic objects on the surface, the airborne magnetometer delivers precise data in a continuous trace, rather than the coarser record obtained by point-to-point ground surveys. *And the aerial study is completed at a small fraction of the time and cost of ground methods.*

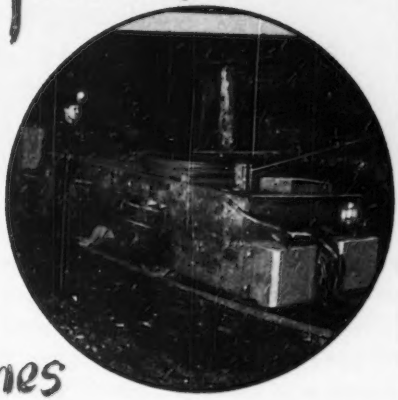
Aero Service will place its expert magnetometer staff at your disposal. Each man is backed by AERO's 30 years of mapping experience and over 200,000 square miles of successful magnetometer surveys all over the globe. Let us show your engineers and geologists how the improved Gulf airborne magnetometer, coupled with AERO's precise correlation of aerial data and ground positions, can profitably meet your particular requirements. Your inquiry is invited.



AERO MAPS THE FUTURE

TOPOGRAPHIC MAPS • PLANIMETRIC MAPS • PRECISE AERIAL MOSAICS • AIRBORNE MAGNETOMETER SURVEYS • RELIEF MODELS • COLOR PHOTOGRAPHY

For Surface Mines...



...For Underground Mines

...A SAFE, DEPENDABLE CABLE FOR SIGNAL AND CONTROL CIRCUITS.

In open air or underground, Simplex - ANHYDREX Signal and Control Cables have what it takes to provide safe, trouble-free service under all operating conditions.

Anhydrex SA insulated and neoprene jacketed, they provide:

Excellent Electrical Properties
- — High dielectric strength
- — Low power factor
- — Low dielectric constant

Protection Against Operating Hazards
- — Water and moisture
- — Grease and oils
- — Heat and sunlight
- — Bad weather
- — Rough handling

Safe Operation
- — Anhydrex SA insulation has stable electrical properties and is physically durable to withstand rigorous service. The neoprene jacket is especially tough and it will not support combustion.

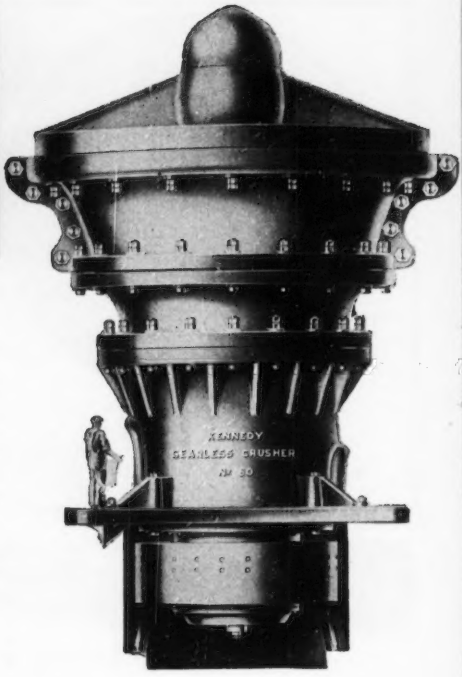
Simplex-ANHYDREX Signal and Control Cables have no metallic coverings to crystallize and corrode; are not harmed by vibration and stray currents. They are flexible, lightweight, and small in diameter; easy to install, splice, and terminate.

SIMPLEX-ANHYDREX

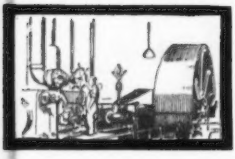
WRITE FOR CATALOG 1013

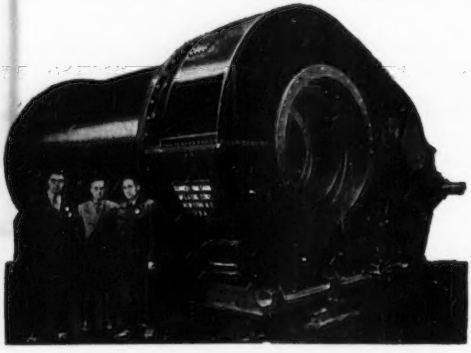
SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

MORE CRUSHING FOR LESS POWER



When you use a "KVS" Gearless Crusher KINETIC ENERGY gives you ADDED FREE POWER for no added cost. That's the extra power that results when a big pulley or flywheel whirls around—remember the big pulley as pictured here on the old Corliss Engine? There's a BIG Pulley in the "KVS" Gearless! It whirls around at a speed of 3,500 ft. per minute—and what EXTRA crushing power you get! What's more, the 8-ton pulley (used in a "KVS" Gearless Crusher weighing 400,000 lbs.) whirls so easily you can turn it with TWO FINGERS! In short, more CRUSHING for LESS POWER COST (with much less vibration and much less NOISE, too), is the idea that puts "KVS" way out in front, and keeps it there!





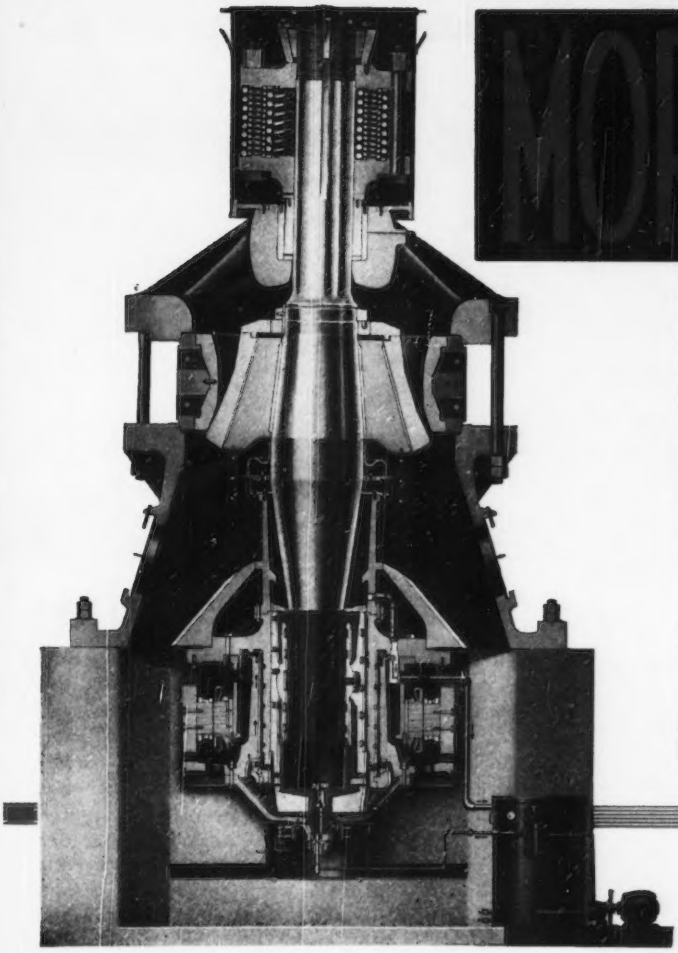
Save a young fortune on a synchronous motor!

Yes—you can save up to $6000 on a 10 ft. tube or ball mill if it's a "KVS" with integral gear drive. Why? Because the motor is DIRECT CONNECTED to driving shaft. Shaft is carried in roller bearings that CANNOT be misaligned or set wrong. The pinion shaft to which the motor is connected runs at approximately 600 r.p.m. while pinion shafts in other people's mills run at about 180 r.p.m. ON A 10 FT. KENNEDY MILL THIS ENABLES YOU TO PURCHASE THE SYNCHRONOUS MOTOR at a tremendous SAVING! What's more, "KVS" trunnions on large sized tube and ball mills are CARRIED ON OIL. Bearing never wears out, uses little power. All gears and bearings are automatically sprayed with oil before tube mill is started (Design patented). Believe it or not, in 15 years no "KVS" gears or pinions have worn out on this type mill.

MORE THAN $5000 SAVING

Kennedy-Van Saun
MANUFACTURING AND ENGINEERING CORPORATION
2 PARK AVE., NEW YORK 16, N. Y.
FACTORIES:
DANVILLE, PA., U.S.A.
CANADA, ENGLAND, FRANCE, AUSTRALIA

The



MORE PROOF OF TYPE "S" SUPERIOR PERFORMANCE

SPEAKING OF CRUSHING . . . .

LOCATION: NATIONALLY KNOWN MINING CO. IN NEW YORK STATE

CRUSHERS: FOUR NO. 37½ KENNEDY TYPE "S" ROLLER BEARING GYRATORY CRUSHERS

FEED OPENING: 6¼"; **DIAMETER OF HEAD:** 3 FEET

DISCHARGE SETTING: 7/32" CLOSED SIDE AT HEAD

CAPACITY EACH CRUSHER: 56 TONS PER HOUR

HORSEPOWER EACH CRUSHER: 48 HP.

CLOSED CIRCUIT OPERATION

GRADATION AS FOLLOWS:

THE FIGURES!

99.8%	Minus	3	MESH
93.3	"	4	"
80.6	"	6	"
66.6	"	8	"
56.1	"	10	"
48.1	"	14	"
40.6	"	20	"

Can You Equal These Figures?

A "2-fisted" Swing Jaw Crusher!

MORE OUTPUT FROM EACH JAW

See? All 1 piece except jaw plates

You lose dollars when all crushing load is carried on the swing jaw! In the "KVS" the stationary as well as the swing jaw carries 50 percent of load . . . result, LESS POWER keeps the swing jaw crushing. Note also swing jaw is ONE PIECE, except renewable crushing plate. Swing and stationary jaws are interchangeable, both same length, reversible end-for-end, giving DOUBLE jaw crushing life.

Products with the troubles LEFT OUT

2 TOURNADOZERS on Cuyuna

Builds Roads—Tournadozer builds, maintains truck roads. Fast, accurate grading is made possible by finger-tip electric controls, easy steering.

At Dump—Tournadozer's big blade rolls large load of sand each pass. Constant-mesh transmission keeps rig rolling without loss of momentum.

Mobile, rubber-tired "C's" on job 24 hours a day, 7 days a week

One of the large iron mining companies operating on the Cuyuna Range near Crosby, Minnesota, found its two C Tournadozers ideally suited to the extensive round-the-clock pit and dump work necessary for efficient stripping.

They have permanently assigned one of their mobile rigs to a large sand overburden dump. Here, in addition to leveling truck-dumped loads, "C" maintains haul roads, grades sides of dump, and assists trucks through sand when going is tough.

The second high-speed Tournadozer . . . detailed to handle utility jobs .9 to 2.7 miles

LeT

See your Le Tourneau Distributor NOW for complete information

speed stripping Range

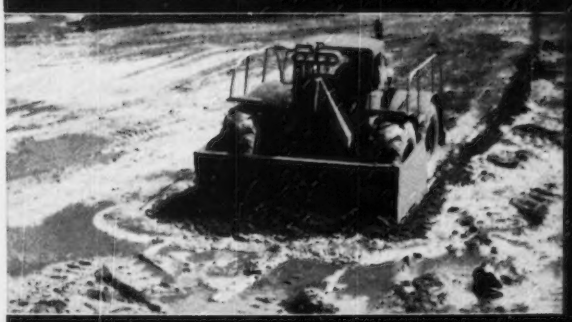
Dozes Overburden — Tournadozer's multiple-disc air brakes, instant controls, and sure four-wheel traction permit it to work safely on steep grades of dump.

apart . . . in one typical 8-hour shift, cleaned around two large shovels . . . cleared ore bed for new shovel location . . . swept spillage from hopper . . . and graded old track location for haul road to proposed dragline site.

Travel everywhere at high speeds

Both of these rubber-tired rigs travel anywhere on or off location — over pavement, cross-country, or over railroad tracks — without damage to surface, rails, or tires. Their high speeds forward *and* reverse complete dozing cycles in 1/3 the time it takes slow-moving crawlers. These are only two of the many reasons why Tournadozers meet the multiple needs of this Cuyuna Range mine and why you, too, should investigate this modern rubber-tired dozer for extra speed and *plus* profits. Find out the many other uses for the Tournadozer. Your local LeTourneau Distributor can give you all the facts. Phone him TODAY!

Sweeps Around Hopper — Short turn radius, extra maneuverability, easily-operated blade, make Tournadozer ideal for clean-up at hopper.



Cleans Ore Bed — Dozing in third gear, Tournadozer completes three cycles to crawler's one . . . quickly cleans bed for new shovel location.

Rubber-tired Tournadozer travels anywhere at high speeds—on pavement or cross-country—through sand or soft muck—over railroad tracks without planking.

Tournadozer-Trademark Reg. U. S. Pat. Off. M23

LETOURNEAU PEORIA, ILLINOIS JOB-PROVED Over 6445 Built and Shipped TOURNADOZERS

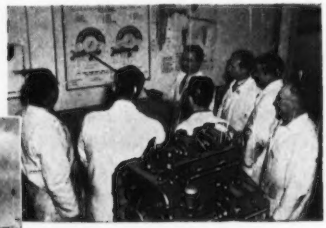
IT'S RUBBER THAT PUTS THE ACTION IN TRACTION

Wherever you are you're not far from

...GM DIESEL

OWNERS of General Motors Diesel engines and GM Diesel-powered equipment know they can depend upon receiving courteous service *after* as well as *before* the sale. They know that, wherever they are, a GM Series 71 Diesel Distributor or Dealer is ready to answer call for a quick tune-up, a repair or a Factory-Engineered GM Diesel part. Staffs of factory-trained service men have the tools, the know-how and a thorough, capable interest in seeing that every engine delivers its best. Here, for your convenience, is a list of GM Diesel Industrial Distributors and Dealers in strategic locations throughout the United States.

Service Backed by Training



AT THE FACTORY—GM Distributor and Dealer service men, as well as customer personnel, take courses in the maintenance and repair of GM Series 71 Diesel engines at the Detroit Diesel Engine Division Factory Service School. Classes of 12 students are scheduled every two weeks. Enrollment is limited so that each participant may be assured of personalized instruction, with emphasis on actual shop procedures.

IN THE FIELD—Completely equipped Mobile Training Units, currently touring the country, bring specialized instruction in the proper operation and maintenance of GM Diesel engines to contractors' personnel. Itinerary of the units includes scheduled visits to major construction and mining projects as well as stops at GM Distributor points where groups of smaller contractors' personnel meet for 2 or 3 day courses.

Diesel Brawn Without the Bulk

GM
GENERAL MOTORS
DIESEL POWER

ALABAMA—Birmingham
ARMSTRONG EQUIPMENT CO.
Montgomery
ALABAMA MACHINERY & SUPPLY CO.

ALASKA—(Seattle, Wash.)
Anchorage, Fairbanks
YUKON EQUIPMENT, INC.

ARIZONA—Phoenix
STATE TRACTOR & EQUIPMENT CO.

ARKANSAS—Stuttgart
EDDINS SERVICE
Little Rock
LEWIS DIESEL ENGINE CO.
Morrilton, LOVE SUPPLY CO.
Fort Smith
R. A. YOUNG & SON, INC.

CALIFORNIA—Los Angeles
ANDERSON-O'BRIEN CO.
Lancaster, LANCASTER ENGINE CO.
Stockton, Fresno
MOORE EQUIPMENT CO., INC.
Berkeley, Ft. Bragg, Eureka, N. Sacramento
WEST COAST ENGINE & EQUIPMENT CO.
Bakersfield
FARM IMPLEMENT & ENGINE CO.
Corcoran, FARMERS MACHINERY CO.
Visalia
TULARE COUNTY TRACTOR CO.

COLORADO—Denver
THE COLORADO BUILDERS' SUPPLY CO. (Equipment Div.)

CONNECTICUT—Hartford
HOLMES-TALCOTT CO.

FLORIDA—Jacksonville, Miami
GENERAL MOTORS CORPORATION
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Tallahassee, ARTHUR F. SWAIN CO.
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Orlando, SQUARE DEAL MACHINERY & SUPPLY CO.
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EQUIPMENT SALES & SERVICE CO.
Sebring, H. N. WEBSTER HEATING & COOLING, INC.
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DIESEL SALES & SERVICE, INC.
W. Palm Beach
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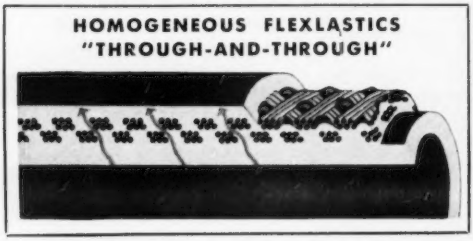
SINGLE ENGINES..Up to 275 H.P. **DETROIT 28, MICHIGAN** MULTIPLE UNITS..Up to 800 H.P.

GENERAL MOTORS

Miners asked for this TOUGH HOSE TEAM!

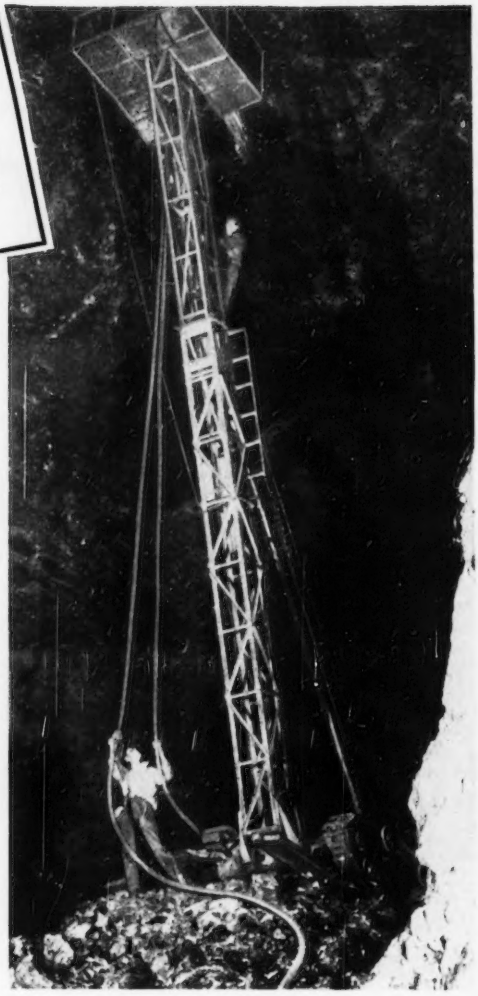
...to take all of the abuse of Hard Rock Mining

No hose construction has ever been developed to equal Condor Homoflex HEAVY DUTY AIR HOSE and WATER HOSE for flexibility and ability to cushion shock. It's not just a matter of an extra thick cover to withstand the gouges of falling rock and dragging over jagged footings in mines and quarries. The Homoflex "toughness" is more than cover-deep; it is toughness through and through.



The enlarged cross section illustration of the Homoflex Hose wall shows how the cover, strength member, and tube are "fused" into one homogeneous unit. You can't separate any part of this hose from another. It is this construction, with all the sinewy resilience of its strength member embedded in Flexlastics that makes possible lighter weight, extreme flexibility and resistance to kinking, with no sacrifice of safe working pressure.

Ore miners and quarrymen have long called for better hose to take the abuse of falling rock, sharp bends and rough handling. Miners can't "baby" hose. If it doesn't stand up, it is sometimes a risk to safety and always costly to replace. To answer the toughest of all hose problems, Raybestos-Manhattan engineers developed the TWIN TEAM of Condor Homoflex HEAVY DUTY AIR HOSE and Condor Homoflex HEAVY DUTY WATER HOSE.



Here's a Condor Homoflex Air and Water Hose Team suspended from a telescopic mast where a Jumbo drill is taking down roof. Air hose is working at 100 pounds pressure in this Oklahoma zinc mine.

Now, wherever wet drilling is done, this team of Homoflex Air and Water Hose is in demand. If you are not yet using Condor Homoflex Hose on your wet drills, get some from your nearest Manhattan Distributor. It's a good way to end hose kinking or collapsing and assure peak drill production with a constant, full feed of air and water through the hose.

(Condor Homoflex Heavy Duty Air Hose has an oil-proof tube, and is ideal for all other heavy-duty mining, quarrying and construction work).

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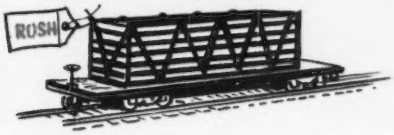
RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

WHAT'S A Delivery Promise THESE DAYS?



A promise is still a promise, and Colorado Iron Works is proud to be known as a promise keeper. There's a rule of long standing at Colorado Iron that no delivery is to be missed—ever.

Here is a recent example of the appreciation prompt deliveries receive:

"The management has asked me to write you and express our appreciation at receiving this machine right on schedule. We realize how difficult it is to meet delivery promises these days, and you and your organization are to be congratulated on the manner in which our order was handled. It has helped us a great deal at this end, and will enable us to have the densifier in place with all connections made several days ahead of the anticipated date."

This is a paragraph quoted in its entirety from a letter dated Sept. 30, 1948, from the American Zinc Company of Tennessee after receipt of a 48" Akins densifier from Colorado Iron Works Company.

Quality must be maintained with delivery. Colorado Iron engineers have consistently turned out products which are capable of giving better results than were originally specified, say the operators.

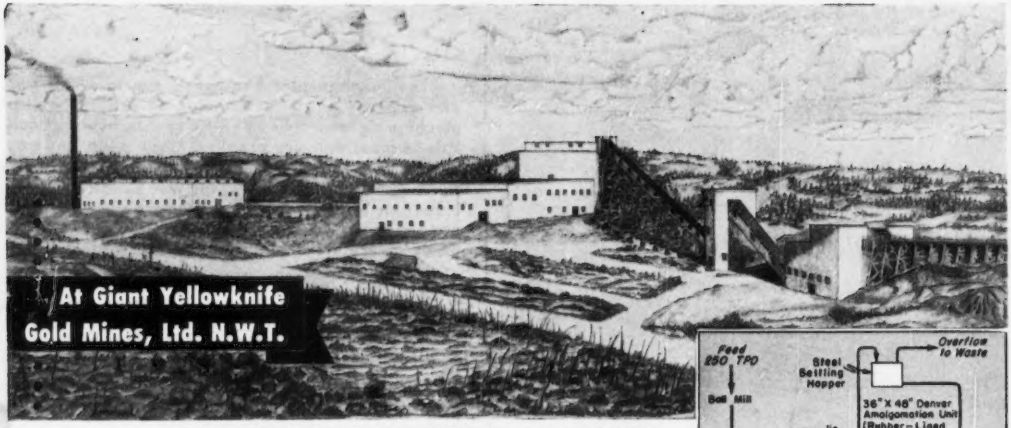
Ask for the figures that prove these statements—we have them! For top performance and on-time delivery, permit our engineers to consult on your milling problems and plans.

A battery of five Akins classifiers in use at the Noralyn mine of International Minerals and Chemical Corp.

COLORADO IRON WORKS COMPANY

MAIN OFFICE & WORKS, DENVER 2, COLO., U. S. A.

Canadian Locomotive Co., Ltd., Kingston, Ont., Can.; Head, Wrightson & Co., Ltd.; Stockton on Tees, Eng.; John Carruthers & Co. (Pty.) Ltd., Sydney, Aus.; Vancouver Iron Works, Ltd., Vancouver, B. C., Can.; Head, Wrightson & Co., S. A. (Pty.) Ltd., Johannesburg; Edw. J. Nell Co., Manila, P. I.



GOLD IS RECOVERED "AS SOON AS FREE" BY DENVER SELECTIVE MINERAL JIGS

BECAUSE Denver Selective Mineral Jigs handle unclassified feeds, GOLD—and other minerals—can be *recovered as soon as free.*

THE PROBLEM presented to the engineering and operating staff of Giant Yellowknife Gold Mines, Ltd., Yellowknife, N.W.T., was to recover gold as soon as free and ahead of flotation for 3 reasons:

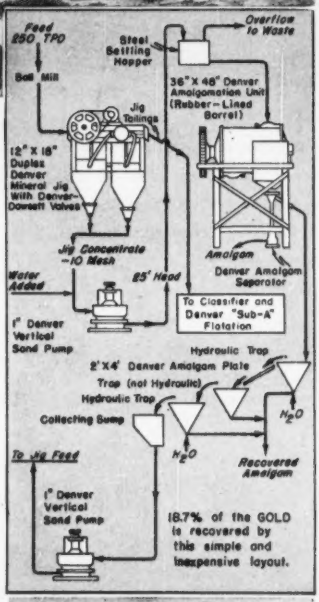
(1) *Secure operating revenue during mill construction.*
(2) *Assure more uniform value in feed to flotation circuit, and thus safeguard against loss of tramp gold in flotation tailing.*
(3) *Prevent tie-up of coarse gold in subsequent roasting.*

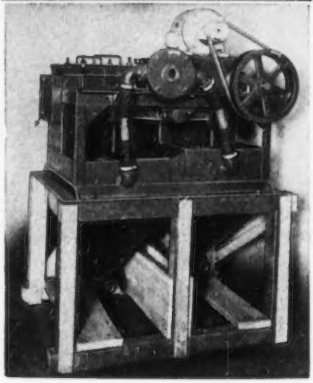
SOLUTION: A 12" x 18" Duplex Denver Selective Mineral Jig, equipped with Denver Dowsett Valves for continuous discharge of concentrate, was placed in ball mill-classifier circuit. Flowsheet shows jig and amalgamation circuit.

RESULT: 18.70% of gold is recovered before there is any possibility of free gold becoming tied up or lost. Net recovery and net profits are increased.

SIMPLE, INEXPENSIVE INSTALLATION Denver Selective Mineral Jig handles unclassified feed—makes high grade concentrate. Water is added to jig product to provide required dilution for pumping by a 1" Denver Vertical Sand Pump to Amalgamation circuit. Amalgamation circuit contains an 18" x 36" Denver Amalgamating Unit with rubber-lined barrel. Simple, inexpensive amalgam traps recover any amalgam or gold which escapes separator. Amalgam tailing is returned to grinding circuit by a 1" Denver Vertical Sand Pump.

Pending completion of Roasting and Cyanidation units, the sole source of revenue was gold recovered from amalgamation of Denver Selective Mineral Jig concentrate.





RECOVER YOUR MINERAL "AS SOON AS FREE"

There is real economic value in this old mining proverb. IT APPLIES TO ALL MINERALS. Often the savings in additional mineral recovered will pay for entire installation in a few months. Reliable laboratory tests can determine the extent to which Denver Selective Mineral Jigs can help you. WRITE TODAY for complete information on Denver Selective Mineral Jigs (which are available in sizes up to 24" x 36") or Denver Ore Tests.

DENVER EQUIPMENT 24 HOUR SERVICE COMPANY

FLOTATION ENGINEERS

"The firm that makes its friends happier, healthier and wealthier"

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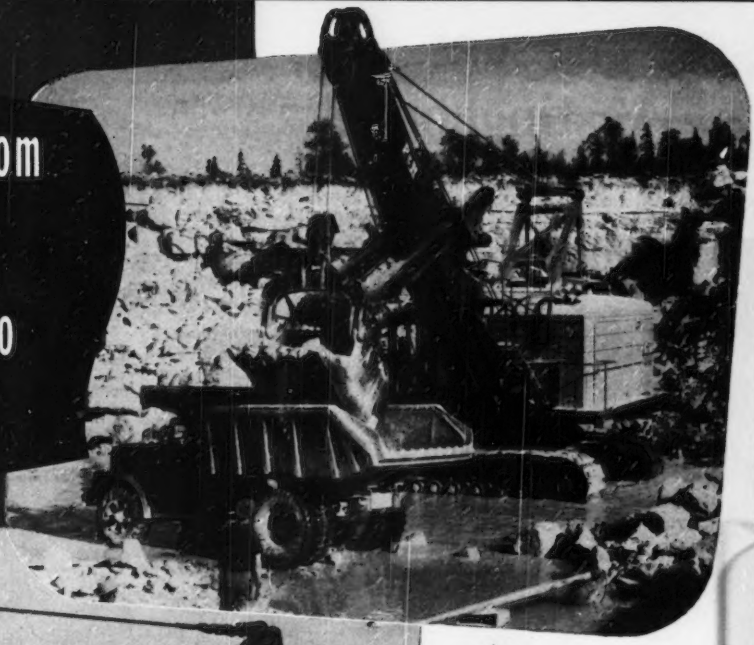
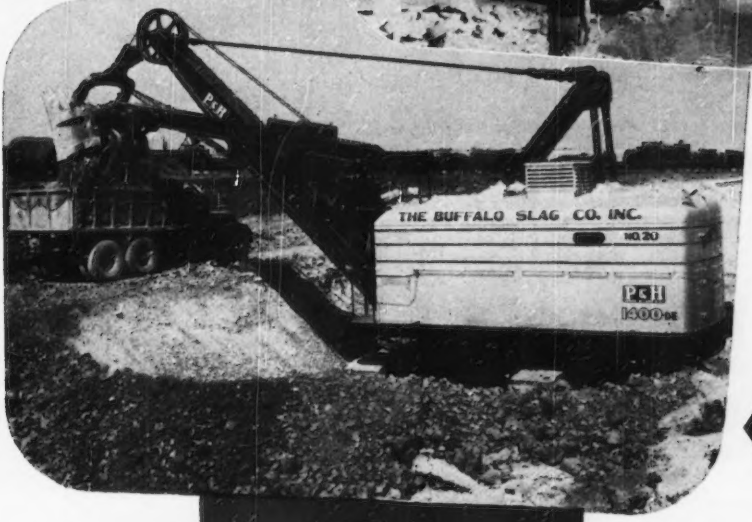
DENVER EQUIPMENT COMPANY, 1402 17th St., Denver 17, Colorado

For Rock Bottom Costs From Start to Finish!



START . . . FLUXING STONE
A P&H Model 1400 Diesel-Electric (4 yd.) shovel, owned by Drummond Dolomite Inc. at Drummond Island, Michigan.



FINISH . . . BLAST FURNACE SLAG
A P&H Model 1400 Diesel-Electric shovel owned by the Buffalo Slag Co., Buffalo, New York.

P&H DIESEL-ELECTRIC SHOVELS

with *MAGNETORQUE** HOIST DRIVE

Now, you can have electric shovel efficiency *anywhere* with a P&H Diesel-Electric quarry and mining shovel. It's a complete electric shovel . . . with the addition of a diesel engine to furnish power . . . entirely independent of high line service.

Years of the toughest rock digging have proved the P&H Diesel-Electric from every standpoint . . . dependable operation . . . less maintenance . . . rock bottom tonnage costs.

This simplified P&H Diesel-Electric shovel is made possible by the exclusive P&H Magnetorque Hoist Drive. Hoist generator, hoist motor, slip friction clutch and other mechanical devices are completely eliminated. Magnetorque is only one of many P&H Added Values. Ask for Bulletin X83-DE.

Every Third P&H Electric Shovel Sold is a Repeat Order.

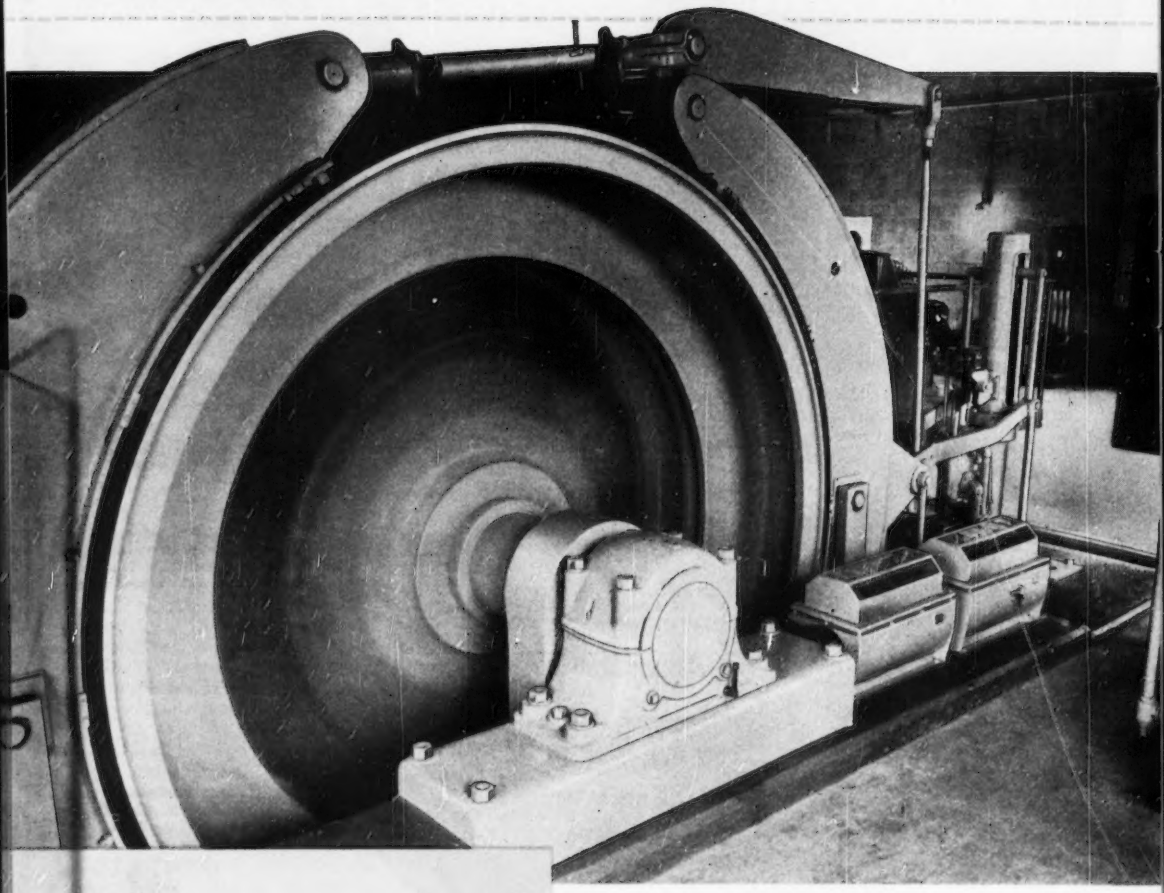
*Trade-Mark of Harnischfeger Corporation for electro-magnetic type clutch

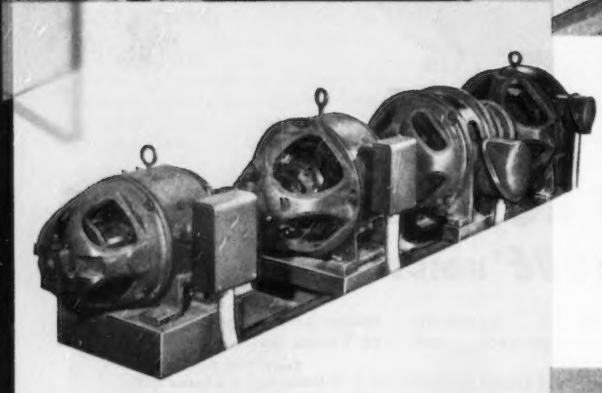
P&H **ELECTRIC SHOVELS**
4454 West National Avenue
Milwaukee 14, Wis.

HARNISCHFEGER CORPORATION

YOU CAN BE **SURE**.. IF IT'S

Westinghouse





"Operatorless operation" is provided by this new Westinghouse-equipped Automatic Hoist installed in the Green Valley and Wabash Mine of the Snow Hill Coal Corporation. After the hoist is placed in operation at the start of a shift, the automatic control provides continuous hoisting. It moves coal from the hopper onto the weighing pan, fills the skip, travels it upward, dumps it and returns it for another load. The cycle is repeated indefinitely until stopped, or until there is no coal left in the hopper.

These Rototrol rotating regulators provide the "judgment" for automatic control. They assure uniform time cycles of preset duration, smooth stopping and accurate positioning of the skip at the loading pocket and on the dumping horns.

WESTINGHOUSE

Westinghouse

EQUIPMENT FOR THE MINING INDUSTRY

NOW... AUTOMATIC HOIST OPERATION

FOR MORE TONS PER MAN-HOUR

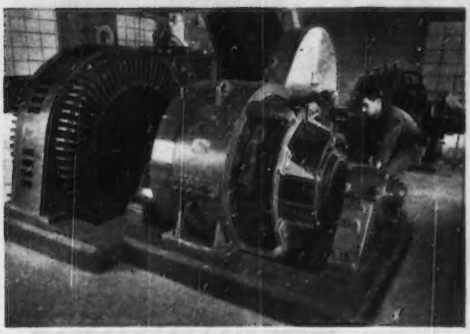
The installation shown at the left is the Westinghouse-equipped Automatic Hoist in the new mine of the Snow Hill Coal Corporation in Indiana. The operation is continuous and completely automatic.

Using the Rototrol rotating regulator as a robot control, the hoist moves up to 700 tons an hour at any preselected working level. The operator simply sets the hoist at the beginning of the shift.

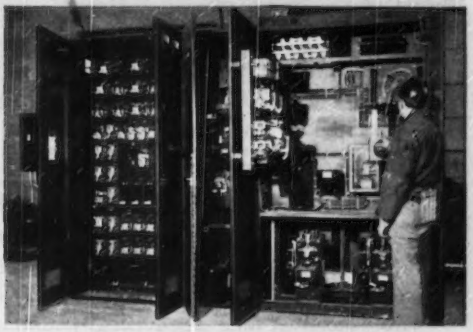
This Automatic Hoist is the latest addition to the complete line of Westinghouse drives for coal, metal and nonmetallic mine hoists. It is one more example of how Westinghouse co-ordinated engineering meets the need of the mining industry *for more tons per man-hour.*

If you have an underground hoisting problem, Westinghouse Mining Industry Specialists will gladly help you select and apply the right electric drives. Call your nearest Westinghouse representative, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-94808



This 1000-kw, 720-rpm synchronous motor-generator set supplies power for the automatic hoist. In the background may be seen the 1250-hp, 450-rpm, d-c motor and the cylindro-conical cable drum with maximum rope speed of 2485 fpm.

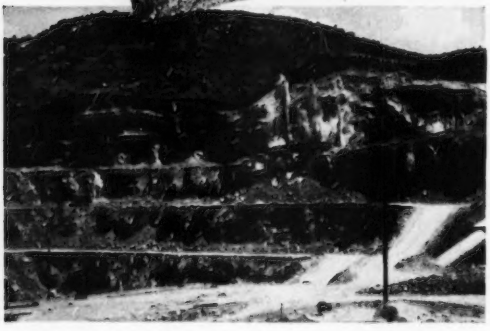


The control center unit provides two types of control. (Left) The relay board, containing relays, circuit breakers and contactors, gives automatic operation. (Right) When desired, the operator can operate hoist manually for inspection.

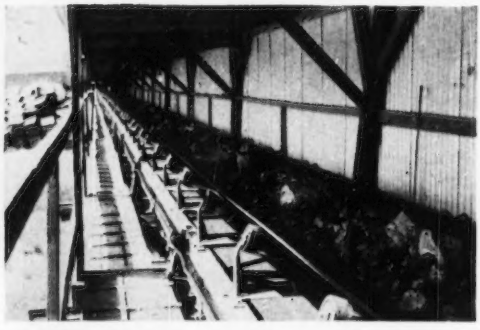
NYLON MAKES NEW BELT UP TO 250% STRONGER

Also provides more flexibility... easier training... carries heavier tonnage... is easier to repair

HERE A 2,300 FOOT cotton-nylon belt system is moving more than 700 tons of ore per hour. Use of nylon in combination with cotton yarns makes possible a greater number of fabric plies which increases overall belt strength by as much as 250 per cent.



THE SERVICE REQUIRED of conveyor beltings in this mining region demands a thick belt with great elasticity and high abrasion resistance. Despite its thickness this "U. S." Belt has greater flexibility, to conform more easily to path and contour of idler pulleys. This increases tonnage, reduces spillage.



KNOWN AS STYLE YN, this belt has been specially designed to accelerate the ever-expanding scope of mechanization, making possible longer centers and higher lifts resulting in ever-increasing economies. In speed and facility of repairs this belt is unequaled in its class.

If you have any problem involving conveyor belting, talk it over with our engineers. They will gladly work with your own men in advising, planning or executing any job. Write Mechanical Goods Division, U. S. Rubber Company, Rockefeller Center, New York 20, N. Y.

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SERVING THROUGH SCIENCE

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● In a recent survey, one customer gave "Good service on special sizes" as his reason for ordering his steel from United States Steel Supply Company. And his words summed up the statements of many of our customers. Whenever your problems involve steel in special sizes, forms or specifications, call United States Steel Supply Company. We'll do our best to live up to our customers' high opinion of our service.

Service Plus includes many things besides "Good service on special sizes," however. It features prompt delivery, large capacity and an unrivaled reputation for service. *Service Plus* specializes in courteous attention to your every requirement —it's our way of saying *we'll do all that is humanly possible to supply you with the steel you want . . . where you want it . . . when you want it.*

WHEN YOU DEAL WITH US, YOU GET Service Plus!

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UNITED STATES STEEL

HAZARD ARMORED SHAFT CABLE

Stands up longer

IN THIS TOUGH SERVICE

Cable suspended securely by individual steel armor wires at top of shaft.

Cable terminated in dust-tight junction boxes at both top and bottom of shaft.

Cable suspended at top hangs free in shaft with no clamping to timbers, thus permitting harmful moisture to run off without damage.

Shaft cable puts in a rough day's work. The speeding cage vibrates the shaft timbers and guides; sharp-edged, heavy chunks of coal and rock carom back down the shaft walls. Yet Hazard Armored Shaft Cable has been taking this daily punishment for years in many mines—and is still going strong without any failure.

It's a good example of Hazard's special cable engineering to meet the tough electrical jobs in mines. The photographs on this page show a typical Hazard shaft signal and communication cable installation. The 1400 ft. length of cable has 24 pairs of #14 Awg solid conductor insulated with tough, elastic and long-lived Hazard Watertite, a highly moisture-resistant rubber compound. Galvanized steel armor wire over-all assures lasting mechanical protection.

For shaft cable or any insulated wire or cable for mining use, it will pay you to talk to your Hazard representative. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD insulated wires and cables for every mining use

8044

WRITE FOR YOUR COPY

of Bulletin #5002, a brand new 4-page, 2 color leaflet containing pertinent data on the many features of the Dorrco Type W Pump. This rugged giant will handle up to 75 cubic feet per minute . . . has variable stroke adjustment while in operation . . . is designed for high mechanical efficiency!

THE DORR COMPANY
BARRY PLACE
STAMFORD, CONN.

☐ Yes, I'd like a copy of Bulletin #5002 describing the Type W Pump.

☐ Also send me a copy of Bulletin #5001 covering the V Type Pump.

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If you do not already have Bulletin #5001 covering the Dorrco V Type Pump, check both boxes on the coupon above. No obligation, of course.

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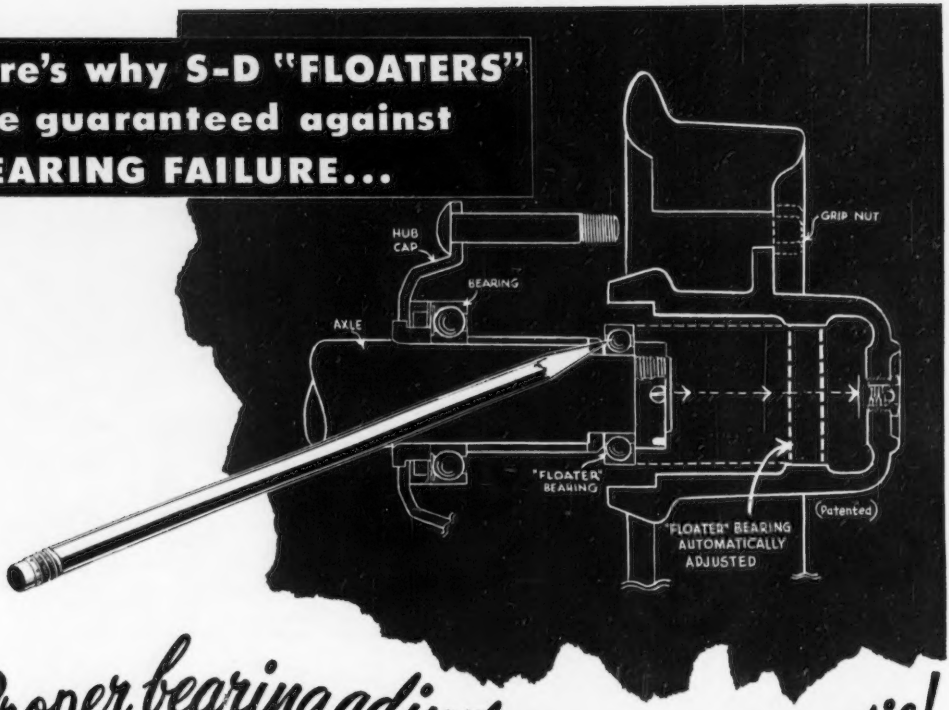
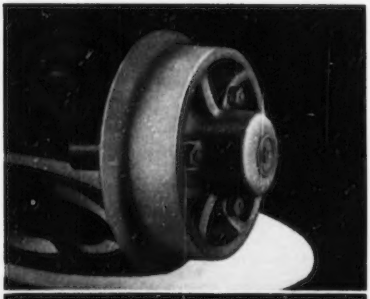
RESEARCH — ENGINEERING — EQUIPMENT

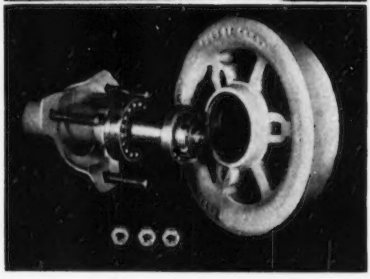
here's why S-D "FLOATERS" are guaranteed against BEARING FAILURE...



Proper bearing adjustment is automatic!

Because one of the two bearings "floats" into perfect adjustment, there are never any loose or tight bearings on S-D "Floater" Ball Bearing Wheels. That's why we can guarantee the "Floater" wheel against bearing failures for 5 years. Diagram above of a demounted "Floater" shows the heart of the wheel—that magic "floating" bearing that automatically adjusts itself when wheel is mounted and the three retaining bolts are pulled up tight. The extra large bearing absorbs all side thrusts and carries the bulk of the load. Any workman on the job can remove and replace a "Floater" Wheel because "Floater" bearings always remain in perfect adjustment on the axle whether the wheel is off or on. Remember, too, that "Floaters" have solid closed front hubs and positive back seals to keep foreign matter out and grease in! That's why so many "Floaters" often run 5 years and more on a single greasing. The S-D "Floater's" low cost of operation is certainly worth investigating. Without question, S-D "Floaters" run easier, run smoother and cost far less in maintenance than any other mine car wheel!





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SANFORD - DAY IRON WORKS

NEEDS NO MUD PROTECTION . . .

GARDNER-DENVER VP4 SUMP PUMP

Mud can't hurt the Gardner-Denver VP4 Pneumatic Sump Pump. Designed on a new principle of TOP-SUCTION—the VP4 can't "dig in"—won't bury itself in a muddy sump—won't block inlet flow.

Top-suction also eliminates one of the most common causes of pump failure—breaking of the pump shaft seal because of water pressure. *Top-suction* keeps all dirt and water away from the oil seal, bearings and air motor—actually pulls lubricant into the seal.

Write for complete information about this *better* sump pump.

GARDNER-DENVER

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Gardner-Denver Company, Quincy, Illinois

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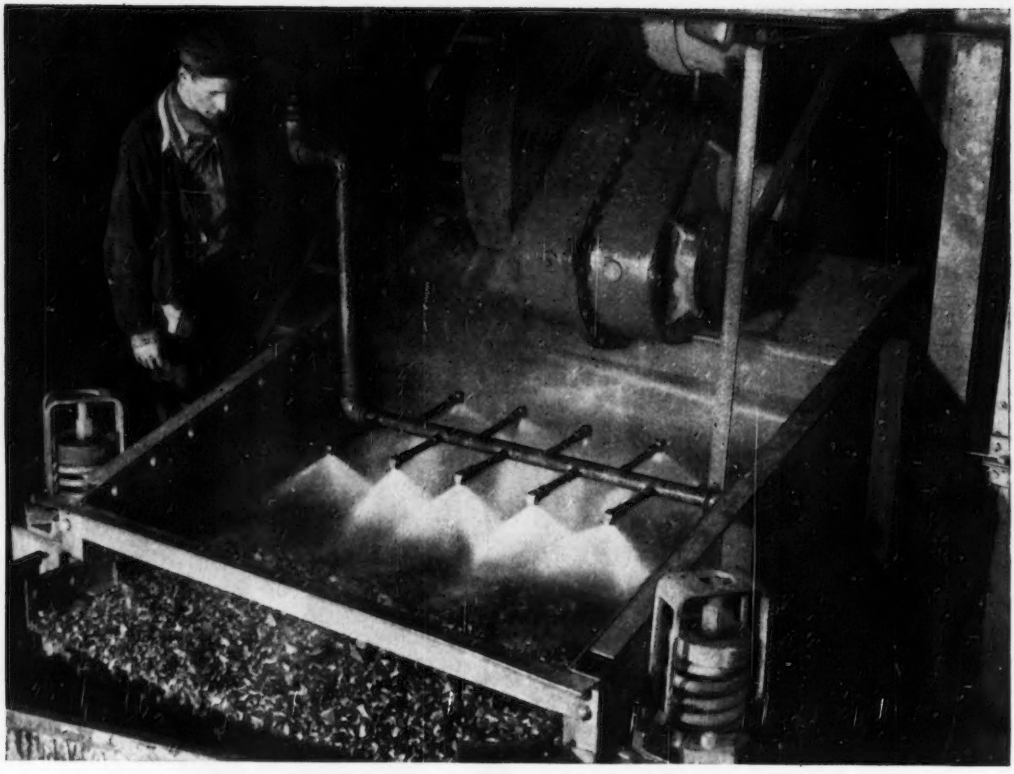
Gardner-Denver Company (Canada) Ltd., Toronto, Ontario



Top Results in Media Recovery — with *Low-Head* Washing Screen

THE FIRST SECTION of this *Low-Head* vibrating screen drains media from iron ore tailings in a Minnesota heavy density plant. The remainder of this single deck, 5x16-ft screen washes media from tailings. Operators are highly pleased with the high media recovery.

Low-Head screens are widely used for draining or washing media from ore in heavy density applications . . . for screening log washer products . . . for wet or dry sizing, rinsing and dewatering semi-fine to semi-coarse ores and aggregates.

- **Horizontal operation saves headroom, reduces installation costs.**
- **Entire screen body "stress-relieved" to eliminate strains around welds.**
- **Can be suspended by cables or floor mounted on rubber mountings.**
- **Available with screen surfaces for abrasive ores.**

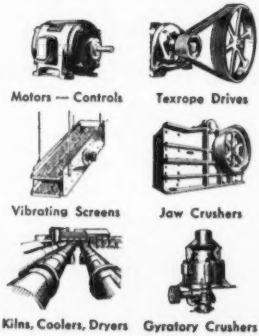
Allis-Chalmers builds six separate types of vibrating screens — a complete line for every application from heavy duty scalping of run-of-mine ore to electromagnetic screens for making fine separations down to 65-mesh (wet).

There is an Allis-Chalmers representative near you who will gladly look over your operations, show you how you may be able to reduce your operating costs with proper screening equipment. A-2941

ALLIS-CHALMERS, 969A SO. 70 ST.
MILWAUKEE, WIS.

Low-Head and *Texrope* are Allis-Chalmers trademarks

IT PAYS TO SPECIFY MOTORS... CONTROLS... V-BELT DRIVES—ALL FROM ALLIS-CHALMERS

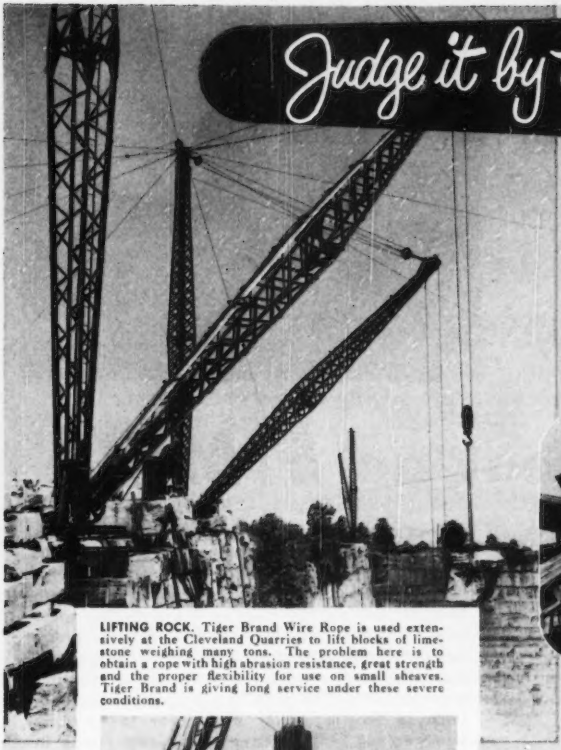


ALLIS-CHALMERS

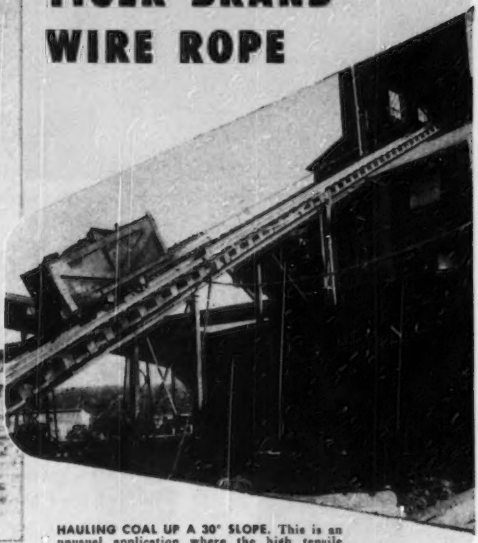
Sales Offices in Principal Cities in the U. S. A. Distributors Throughout the World.

Judge it by the jobs it handles

TIGER BRAND WIRE ROPE



LIFTING ROCK. Tiger Brand Wire Rope is used extensively at the Cleveland Quarries to lift blocks of limestone weighing many tons. The problem here is to obtain a rope with high abrasion resistance, great strength and the proper flexibility for use on small sheaves. Tiger Brand is giving long service under these severe conditions.



HAULING COAL UP A 30° SLOPE. This is an unusual application where the high tensile strength of Tiger Brand Wire Rope assures utmost safety.

THE TIGER SWINGS IT on a special sling made for handling heavy blocks of stone. Wire Rope slings can be obtained to fit your own needs. They do not wear away like hemp and there is no weakest link, as in chains.

NO job is too big . . . too small . . . or too tough for Tiger Brand Wire Rope. You'll find it scooping up 40 cubic yards or more of dirt and rock at a bite on the biggest power shovels—or your wife may be using a smaller size for a clothes line. In either case the rope is correctly designed for the job it handles.

Whatever the application, the Tiger Brand Specialist in your area can help you choose the best wire rope for your needs . . . and he can give you valuable tips on how to care for your rope to get the most service per dollar of cost. Call him in or write for our 125-page handbook on American Tiger Brand Wire Rope. It's yours for the asking.

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AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

UNITED STATES STEEL

Model 12B Eimco in mine in California

Model 12B in Lead mine in California

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To help you help yourself — Eimco offers three bulletins: on drawholes, L1017; on wide headings, L1018; and on tunnels, L1005A. They're available to bonafide mining men. Drop us a card today.

That's the way Eimco RockerShovel users talk —from the machine operators all the way up to Superintendents.

When you put a shovel underground, it's there to work for you. The men must use it—they must like it—it must be dependable! Eimco's alone meet these requirements. They stay underground longer—that's proven by their much lower maintenance costs. The men like them and use them because they're easier and safer to operate, stronger for lifting heavy muck, and faster in loading the cars. Yes, it's a fact established through performance in every mining camp throughout the world . . . You can't beat an Eimco; it is unquestionably the number one loading machine!

Write for more information — there's a RockerShovel to fit your loading needs.

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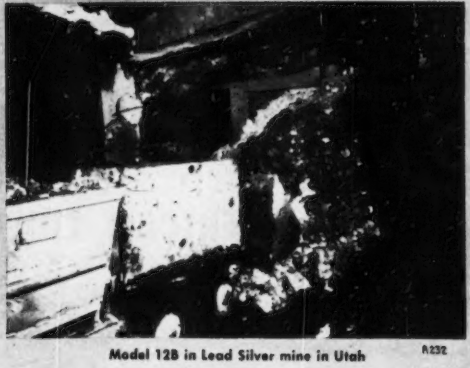
Model 21 in Copper mine in Arizona



Model 12B in Lead Silver mine in Utah

A232

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Design and Application

. . . are *Yours* for the *Asking!*

The Gates "GUIDE for SELECTING or DESIGNING V-BELT DRIVES" is widely recognized as the most *comprehensive* and *complete* book of its kind—and also the *easiest to use.* It enables you to find all the possible combinations of stock drives for your machine with the *least amount of calculation*—and almost *automatically* gives you the drive of *lowest price* that will be adequate for the job.

V Saves You Time, Work and MONEY

The GUIDE tells all about "Design Horsepower" and Speed Ratios—and by merely *scanning* a page of GUIDE designs which use the *stock pulleys* that meet your needs, you can quickly determine the center distances that will fit your equipment layout while, at the same time, enabling you to use *standard belts!*

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As a matter of fact, by using the Gates GUIDE you can design—with a *minimum of calculation—any kind* of V-Belt drive for every kind of operation—including quarter-turn drives and Dubl-V drives.

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The GUIDE is compiled and written by Gates Engineers. It embodies their specialized knowledge gained through operating the largest V-Belt testing laboratories in the world! Here, an average of *32,000 hours* of testing *per week* are run on V-Belts alone! No wonder the Gates "GUIDE for SELECTING or DESIGNING V-BELT DRIVES" is regarded by Engineers as the *authority* on V-Belt Drive design.

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Eng. 501

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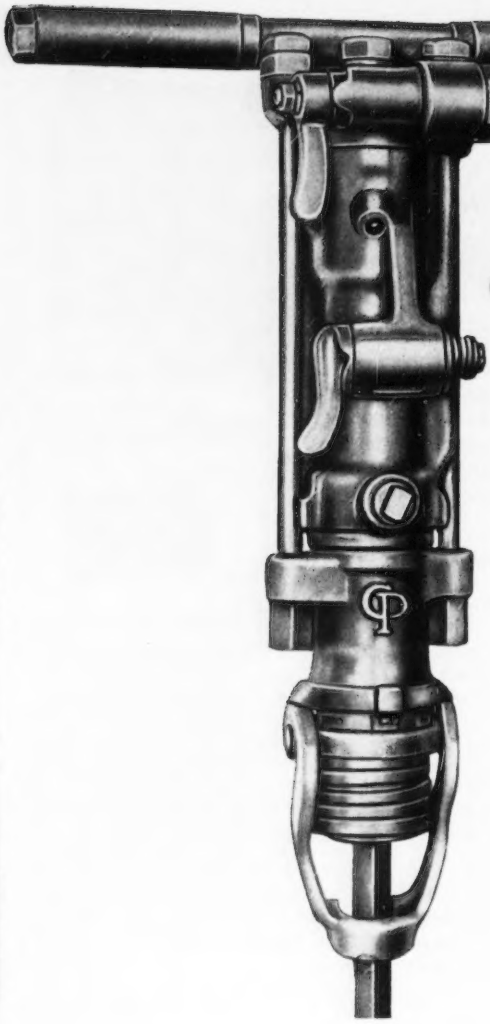


new!

a 55-lb. class sinker with a 4-in-1 backhead

Now, for the first time, you can get a sinker that meets all operating conditions: plain dry . . . blower dry . . . plain wet . . . air-water operation.

The secret is in its "4-in-1 backhead" that meets all four requirements; change-overs from one type to another are quick and inexpensive.

The CP-59 Sinker Drill . . . new in design . . . easy to hold . . . is tops in drilling speed, rotation, hole cleaning and all-around performance.

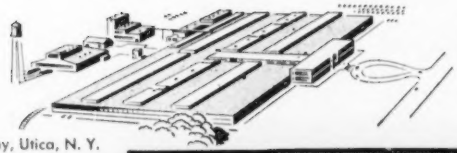
New type valve gives exceptional drilling speed with powerful rotation.

One oil chamber efficiently lubricates entire drill.

Replaceable bronze chuck rotation nut protects piston splines from scoring.

Replaceable bronze cylinder bushing liner makes it easy to maintain full cushion and piston alignment.

See your nearest CP dealer for a demonstration of the outstanding features of the CP-59 Sinker Drill, or write for SP-3009.



With its half million square feet of floor space, Chicago Pneumatic's new Utica unit is the world's most modern plant for the production of pneumatic and electric tools.

Chicago Pneumatic Tool Company, Utica, N. Y.

CHICAGO PNEUMATIC TOOL COMPANY

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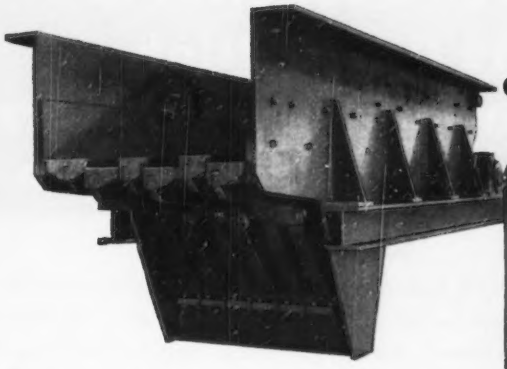
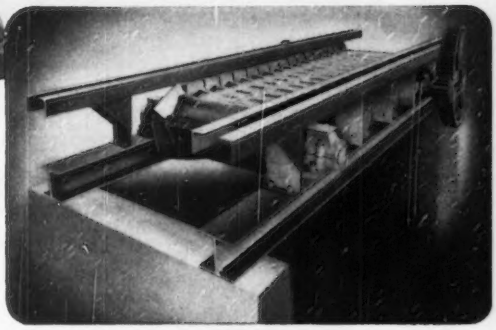
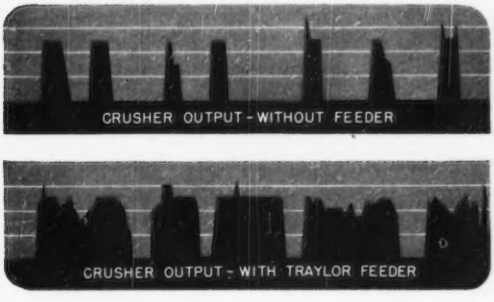
Traylor Feeders Insure a Steady Flow of Profits



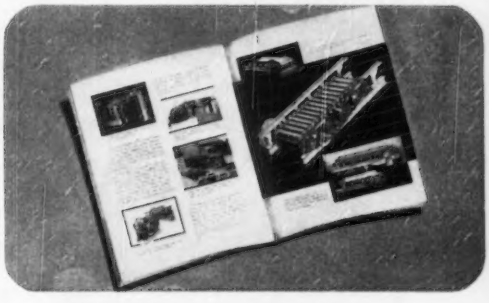


Crushers supplied with an even flow of material produce more tons per dollar of operating cost. Traylor Feeders fitted to your crushers assure controlled feed . . . maximum production with minimum loss of power and time. The Traylor Grizzley Feeder by-passes all undesirable fines . . . supplies a smooth flow of material to the crusher for reduction. Thus your crusher continuously works only on oversize. Traylor Grizzley Feeders are built in sizes from 3′ x 6′ to 10′ x 20′.

The Traylor All-Steel Apron Feeder is recommended for operations in which elimination of fines is undesirable. Over-lapping aprons and flanges of heavy steel present a solid surface . . . carry *all* the material to the crusher. Widths from 30″ to 84″ in any practical length



This chart shows the actual performance of a crusher operating without a feeder (top) and with material supply controlled by a Traylor Feeder (bottom). The black area shows the work accomplished . . . peaks represent full capacity, valleys indicate no load. How a Traylor Feeder doubles crusher production is clearly seen



FREE NEW FEEDER BOOKLET

Traylor builds a complete line of feeders for many purposes. Increase your profits by operating your crushers at their most efficient capacity. Write today for illustrated Bulletin 1114 which describes Traylor Feeders in detail.

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Sales Offices: New York, N. Y., Chicago, Ill., Los Angeles, Calif.
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Rotary Kilns, Coolers and Dryers
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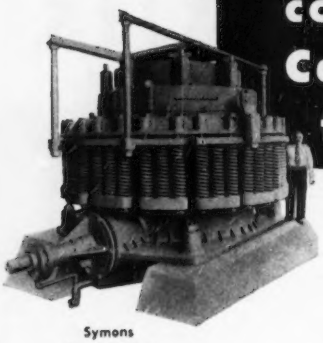
A "TRAYLOR" LEADS TO GREATER PROFITS

NORDBERG supplies a complete line of High Capacity Mining Machinery for increased production

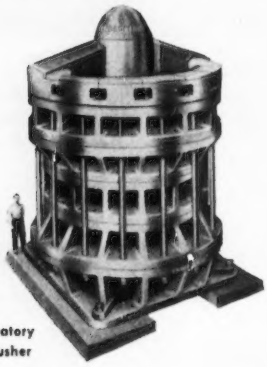


Symons
Cone Crusher

CRUSHING

WHEREVER reduction crushing is required, world-wide experience has proved that Symons Cone Crushers produce greater quantities of sized product within close control limits, and at lower cost per ton. The Symons process of crushing combines *controlled feed, controlled flow* of material through the crusher, *tremendous crushing impact, wide throw* of the crushing head and *controlled, accurate sizing*—a few of the distinctive features of Symons Cone Crushers!

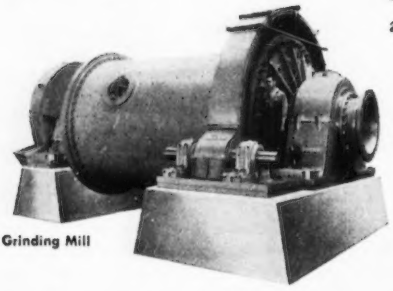
For primary crushing, Nordberg offers heavy-duty Gyratory Crushers from 30″ to 72″ and Jaw Crushers from 36″ x 48″ to 72″ x 96″.



Gyratory
Crusher

SIZING and SCREENING

ACCURATE sizing and screening problems can be solved with Nordberg equipment designed for wet or dry operations. Symons Horizontal Vibrating and Rod Deck Screens and Vibrating Bar Grizzlies are available to meet your requirements.



Grinding Mill

FINE GRINDING

A complete line of large Nordberg Grinding Mills in all types for wet and dry grinding is available in sizes up to 10′8″ diameter and 50′0″ long.

Write for literature on the equipment you need.

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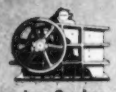


Jaw Crusher

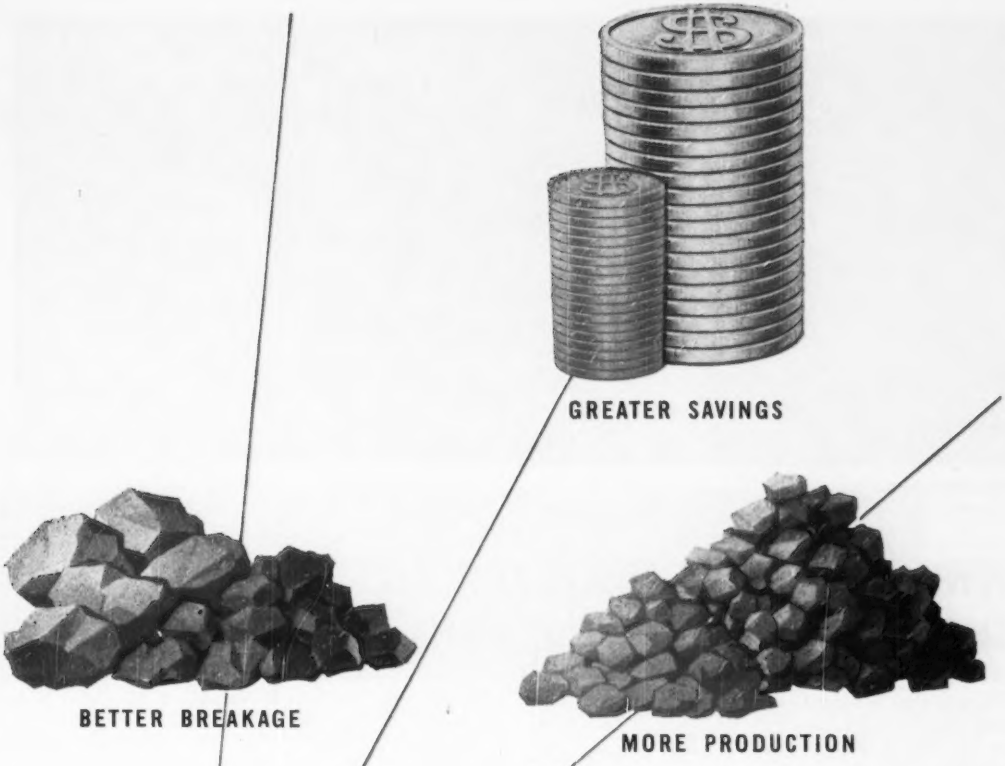
Rotary Kiln

Vibrating
Bar Grizzly

Symons Rod
Deck Screen

Mine Hoist

Diesel Engines



FOR LOWER BLASTING COSTS

You can save three ways by replacing older-type explosives with "Gelamites" and "Hercomites." These Hercules explosives give better breakage, greater production, and are more economical to use than extra dynamites and gelatins. Both "Hercomites" and "Gelamites" come in handy "Tamptite" cartridges. For further information, write for our illustrated booklet "Hercomites and Gelamites for Lower Blasting Costs."

HERCULES POWDER COMPANY
INCORPORATED
933 King Street, Wilmington 99, Delaware

"GELAMITE," "HERCOMITE" AND "TAMPTITE" ARE REG. U. S. PAT. OFF.

XR50-6

HEAVIER LOADING is possible on conveyor belts built with "Cordura" Rayon. This yarn is stronger than natural fibers commonly used. It packs extra strength into conveyor belts and enables them to carry loads to the capacity of power equipment.

WHY YOUR NEXT CONVEYOR BELT SHOULD BE BUILT ON DU PONT "CORDURA" RAYON

The next time you need a conveyor belt, ask your supplier about the remarkable performance of belts built on Du Pont Cordura* High Tenacity Rayon. This industrial rayon provides far greater strength than natural fibers commonly used, and makes a thinner, more workable belt, *at no extra cost.*

This yarn, which puts toughness in heavy-duty truck tires and makes thinner, stronger hoses, can also make more efficient conveyor belts for your mine.

We'll be glad to furnish the names of suppliers of belts made with "Cordura." You can get full information about "Cordura" in the new manual, "Sinews for Industry." It gives physical properties of "Cordura" rayon, describes many successful applications and tells how "Cordura" improves the efficiency of conveyor systems. For your free copy, address Room 4529, Rayon Division, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

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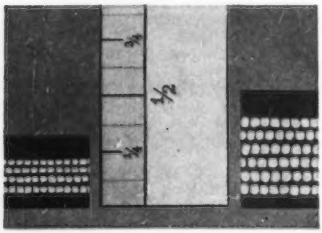
DU PONT "CORDURA" HIGH TENACITY RAYON

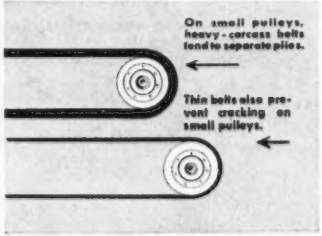
DU PONT

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

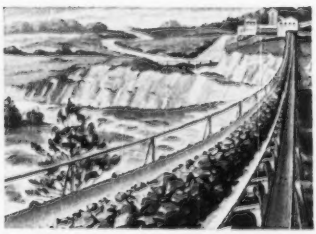
for RAYON . . . for NYLON . . . for fibers to come look to DU PONT



GREATER STRENGTH of belts built with "Cordura" is illustrated above. At left is cross-section of four-ply belt sinewed with "Cordura." It's stronger than conventional 6-ply belt at right, yet only half as thick. This thin, light belt is particularly desirable where panel equipment is moved frequently.



MORE FLEXIBLE. Belts built with "Cordura" have less tendency to crack and separate plies when run over small pulleys required in confined working space. And belts built with "Cordura" have less stretch, so less take-up room is needed. And they trough well under any loading conditions.



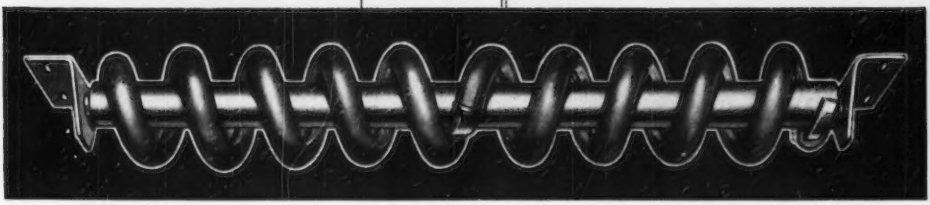
LONGER LIFTS. The high tensile strength of "Cordura" Rayon eliminates costly transfer points. For example, a belt reinforced with seven plies of "Cordura" can lift 1000 pounds of overburden per hour up a 15° slope over 1000 foot centers. It has design tension of 900 pounds per inch of width.

this record proves

THE RETURNS FROM REX SPIRAL RETURN IDLERS

COST RECORD (In a large western coke plant)

TYPE OF IDLER	Steel	Rubber Covered Spiral
SERVICE LIFE	3 months	12 months
COST 1st YEAR	$66.80 for 4	$47.70 each
SAVING 1st YEAR		$19.10
Cost of Replacement		
Subsequent Years (per year)	$66.80 for 4	$18.20 each (rubber covering)
SAVING per year after 1st YEAR		$48.60



Yes, the cost record from *just* this one plant clearly demonstrates the savings possible through the installation of Rex Rubber Covered Spiral Return Idlers.

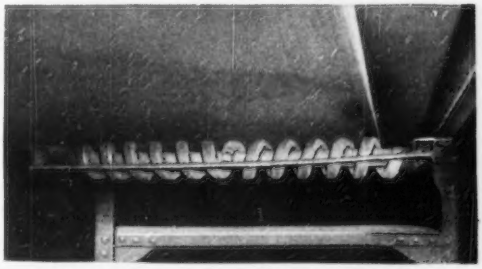
Before the installation of these cost-cutting idlers, the abrasive action of coke breeze clinging to the return side of the belts wore out the standard steel return idlers in an average 3-month period.

15 Rex Spiral Return Idlers were installed for trial and have given at least 12 months' service—4 times longer than the steel idlers. These idlers provide a constant, ever-changing point of contact between idler and belt, preventing build-up of material on the idler and, in some cases, helping to clean the belt.

Cost records show that the 15 Rex Spiral Return Idlers made possible a saving of $19.10 per idler and $286.50 total saving, including initial and installation costs. After the first year, the spiral rubber covering can be replaced, if worn, at a cost of $18.20 per idler. This cost as compared to $66.80, the cost of 4 new steel return idler rolls, indicates a saving after the initial year of $48.60 per year.

Add to these savings, the elimination of down-time caused by the frequent replacement of steel idler rolls, which makes the cost-cutting advantages of Rex Rubber Covered Spiral Return Idlers even more obvious.

Why not investigate the advantages of Rex Spiral Return Idlers and the other idlers in the Rex Line for your operations? Mail the coupon for your copy of Bulletin No. 463R.



Rex Rubber Covered Spiral Return Idlers installed in this western coke plant delivered 4 times longer service than conventional steel return idlers previously used.

CHAIN BELT REX COMPANY — BELT CONVEYOR IDLERS

Chain Belt Company
1679 W. Bruce Street
Milwaukee 4, Wis.

Please send me a copy of Bulletin 463R.

Name.....

Company..... *Dept*.....

Address.....

City..... *State*.....

Why the Champion Iron Mine uses "MS" Delay Caps Exclusively

HOLES PULL TO THE BOTTOM in the Champion Mine of the North Range Mining Company, Champion, Michigan, since Du Pont "MS" Delay Caps have been on the job. Most of the work consists of slabbing rounds with horizontal holes averaging eight feet deep. A typical stope shot uses "MS"-25 Delays in the top row of holes, and "MS"-50, -75 and -100 in the following rows. Several periods are skipped for the corner hole in the bottom row to sweep the bench of muck.

THIS OPERATOR REPORTS that with the use of Du Pont "MS" Delay Electric Blasting Caps, the holes are consistently pulling to the bottom, fragmentation is improved, little or no back break is evident and vibration and concussion have been materially decreased, thus improving safety in the stopes.

MINERS PREFER "MS" DELAYS because the short-length shell makes priming easier, and the brightly colored nylon-insulated leg wires are easy to identify and very resistant to abrasion.

DU PONT "MS" DELAYS come in 14 clearly marked periods ranging from 25 to 500 milliseconds. The caps are double-crimped with rubber plug closures, which makes them waterproof. Protective Cellophane-lined aluminum foil shielded shunts reduce the risk of premature detonation by stray currents.

* * *

Ask your Du Pont Explosives representative for complete information about "MS" Delay Caps. Let him show you why they have gained such wide approval by ore miners. E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Wilmington 98, Delaware.

DU PONT EXPLOSIVES

BLASTING SUPPLIES AND ACCESSORIES

For greater safety in ore work . . .

DU PONT "DETECT-A-METER"

Single instrument with two uses. Detects stray currents and also can be used as a blasting galvanometer. Provides quick check of circuits . . . promotes safety in ore mines and stripping operations.

DU PONT "NITRAMON"* AND "NITRAMEX"**

Designed for open-pit operations, "Nitramon" is the safest blasting agent made. Can't be detonated by a commercial blasting cap, friction, fire or by the impact of ball ammunition. Yet a relatively insensitive Du Pont "Nitramon" Primer detonates charges. Watertight containers permit loading far in advance of firing time.

"Nitramex" is a companion product of "Nitramon," designed for use where hard rock conditions are encountered. Finds wide application as a bottom load for extra energy at the toe.

*"Nitramon" is a registered trade-mark for Du Pont nitrocarbonitrate blasting agent

**"Nitramex" is a trade-mark for Du Pont ammonium nitrate blasting agent.

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BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

T5X CUTS MAINTENANCE COSTS ON DIESEL ENGINES

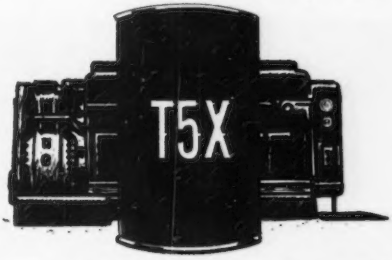
Mine operators with stationary Diesel equipment use the famous purple oil to keep repair costs at a minimum

1. Performance reports from western mine operators *prove* that T5X oil gives far better engine protection. And, according to these reports, the performance of this great purple oil in stationary Diesel engines has been *especially* outstanding.

2. For example, T5X was used exclusively in a GM-671 Diesel engine for three years before overhaul. Yet the engine proved to be *exceptionally* clean. Bearings, rings and other moving parts showed NO wear. And the owner* credits T5X with keeping his maintenance costs at a *minimum*.

*Name available upon request

3. What is this remarkable *purple* oil? It's a highly refined, 100% paraffin-base oil from highest quality base stock. It's a fully compounded, detergent-type oil with a distinctive purple color that comes from an exclusive ingredient which helped give the oil its amazing stability.



4. The powerful combination of additives in T5X enables this great purple oil to do an outstanding job under *severe* conditions. For T5X reduces oxidation; increases bearing protection; and provides greater cleansing action—along with thorough protection against wear.

T5X

Contact your local Union Oil Representative for full information on T5X. Or write Sales Department, Union Oil Company, Los Angeles 14.

UNION OIL COMPANY 76 **OF CALIFORNIA**

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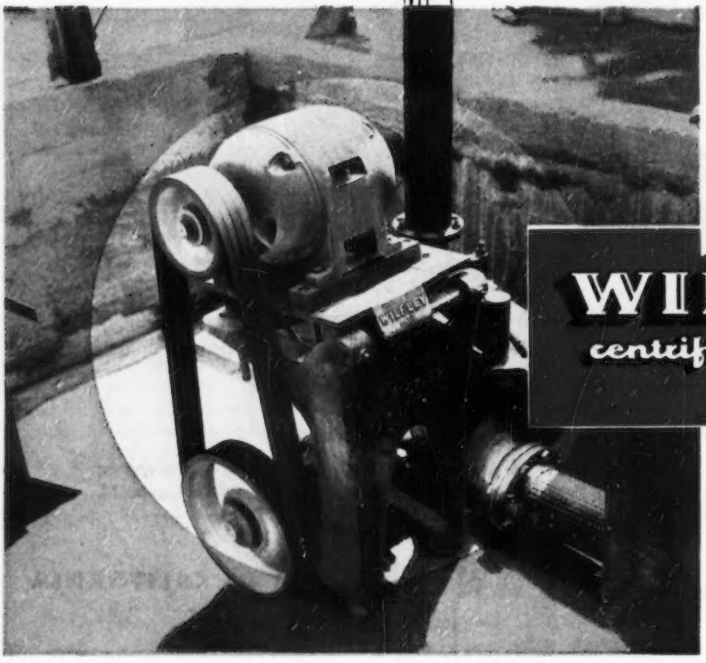
- Continuous trouble-free operation
- Cost-reducing performance
- Stepped-up production

In a recent government dam project, our engineers recommended and installed a 5 inch Overhead V Belt driven WILFLEY Sand Pump (illustrated below). This unit efficiently handles 550 GPM of minus ¼ inch crushed rock, 50 per cent solids and 55 foot head.

In similar projects all over the world, you'll find dependable WILFLEY Sand Pumps right on the job stepping-up production, operating continuously and delivering true high efficiency, with consequent power-and cost-savings. There is an economical WILFLEY Pump size for every pumping requirement. Individual engineering on every application. Write or wire for details.

Buy WILFLEY for Cost-Saving Performance



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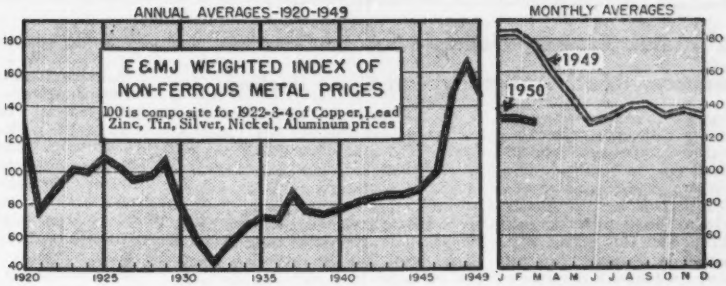
E&MJ OUTLOOK

PRICES



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MARKETS

With new construction still booming, and the outlook brighter for second-quarter business generally, metal markets were firming up as March ended. However, the slump in the lead price during the month overbalanced a rise in zinc and tin to pull the *E&MJ* index of non-ferrous metal prices down to 132.60 from February's 135.65.

Lead, under pressure of foreign metal, fell from 12c. to 10½c., but is making a stand at that figure. Zinc, boosted by demand from galvanizers, rose half a cent to 10¼c. Shortage of wirebars worried copper consumers at the month's end. A strike at Anaconda's Raritan refinery was responsible. Copper sales otherwise carry right on at a high level.

●

LABOR

Could it be that Mine, Mill's leaders, in self-defense, hope to become a catch-all like John Lewis' District 50? Anyway, Mine, Mill now wants to bargain for the employees of a sawmill and lumber yard down in Savannah, Ga. NLRB will hold an election there this month.

●

AT HOME

Production of the hydrogen bomb doesn't mean any slack in the demand for uranium. On the contrary, the AEC will need more than ever.

There must be some good reason why the Munitions Board can't gear its stockpile buying with the markets. Holding aloof while zinc was going begging, now the stockpilers are back buying zinc when it's higher priced, and harder to get. It's not reassuring, to say the least.

Look for some cagey horsetrades in the Congressional arena involving the backers and opponents of: mine subsidies, the tariff on copper, the silver purchase act, large stockpile appropriations, and tax reform for mining. Anything could happen in this election year.

●

ABROAD

South Africa's heavy shipments of "industrial" gold into the French premium market, plus uneasiness among hoarders, shook the price of gold in France from $77 down to about $42 late in March. It may bounce back.

With a three-year surplus of production over consumption of tin facing them, the International Tin Study Group, meeting in Paris late in March, over-ruled the United States on quotas, and dumped the problem into the lap of the United Nations. It means a long, long period of "study," uncertainty, and readjustment, if the UN takes over.

The Bank of England's exchange control board will let Euclid Road Machinery Co. withdraw in dollars at any time the capital and all profits accruing from its British subsidiary company. Euclid is the first American company to get that encouragement.

MARKETS—Trends and Prices

Buying of Metals Extends Well into Second Quarter—Zinc Advances—Lead, Antimony and Silver Decline

DESPITE AN IRREGULAR price pattern in non-ferrous metals, producers booked a good volume of business during March. There was widespread agreement that the outlook for the second quarter has improved and that the use of metals throughout this period will remain at a high level. Activity in the construction and automobile industries will continue to exert a strong influence on the country's economy. As the month ended, consumers showed more interest in obtaining metals for shipment right through June. However, consumers remained extremely cautious about entering into long-term commitments.

Zinc and tin averages were higher for March, but lead and foreign silver declined. The drop in lead was largely responsible for the decline in the E & M J price index from 135.65 in February to 132.60 in March.

The coal strike was settled March 5, which ended a threat to curtail production schedules throughout industry. The end of the strike was followed by a sharp upturn in steel production from 73.5% of capacity early in March to 96.7% as the month ended.

Industrial production in the United States in March, according to a preliminary estimate by the Federal Reserve Board, advanced to slightly above 183% of the 1935-39 average. This compares with 180 in February and 183 in January. In March a year ago the production index was at 184.

Though doubt existed in some quarters over the availability of refinery shapes in sufficient quantity because of unexpected work stoppages at Anaconda's Raritan refinery and at Chuquicamata, Chile, the deliveries to domestic consumers for March again will exceed 100,000 tons.

Workers returned to their jobs at the Raritan plant as the month ended. This news eased the growing tension in the domestic market.

Recent statistics of Copper Institute are summarized as follows, figures in tons:

United States

Production:	(a) Jan.	Feb.
Crude, primary	73,686	70,528
Crude, secondary	11,926	10,688
Totals, crude	85,612	81,216
Refined	95,229	94,036
Deliveries, refined	111,668	112,773
Stocks, refined	101,070	77,472

Outside United States

Production:	(a) Jan.	Feb.
Crude, primary	106,236	110,320
Crude, secondary	1,898	549
Totals, crude	108,134	110,869
Refined	87,923	83,501
Deliveries, refined	81,574	69,193
Stocks, refined	142,971	144,893

(a) Corrected figures.

Shipments of products by fabricators during February contained 102,896 tons of copper, which compares with 108,921 tons in January. Deliveries by producers to the fabricating division of the industry exceeded apparent consumption in the Jan.-Feb. period by 12,624 tons. The Government's stockpile continues to absorb a fairly large tonnage of copper monthly. Stockpile figures are not included in the published statistics.

The position of the industry on the question of the import duty remains decidedly mixed. During the last month both the Treasury and Commerce departments let it be known that they favor the Patterson bill that would continue the suspension of the duty on copper after June 30, 1950. Government officials maintain that the total copper needs of the country will continue well in excess of domestic production.

Copper was firm as March ended, with both the domestic and export quotations unchanged on the basis of 18½c., Valley, and 18¼c., f.a.s. New York, respectively.

Lead Drops to 10½¢

Offerings of foreign lead at sharp price concessions forced producers to take drastic action to correct the situation and restore buying confidence among consumers. On March 9 the price was lowered 1c. per pound to 11c., New York, without attracting much business. Four days later the price fell to 10½c. With both copper and zinc firmer, consumers began to take on larger tonnages of lead. Though most of the business was booked on an average price basis, the volume was sufficient to steady quotations. Pressure of foreign metal in this market also moderated. Producers appeared hopeful that the 10½c. basis can be maintained over most, if not all, of April. Much will depend on the trend in consumption outside of the United States and the dollar credit situation.

Imports of refined lead into the United States in January totaled 29,552 tons, against 23,158 tons in December. Imports from Mexico accounted for more than one-half of the receipts.

United States refineries produced 41,670 tons of lead during February, against 47,512 tons in the preceding month.

Zinc Raised to 10¼¢

Prime Western zinc scored a net gain for the month of one-half cent per pound, establishing the market at 10¼c., East St. Louis. Demand from both galvanizers and die casters was active. Smelters' stocks of slab zinc declined from 82,037 tons at the end of January to 67,419 tons at the end of February. Total shipments during February came to 84,257 tons. Competition to obtain high-grade concentrates is increasing and it was argued that an even higher market for the metal will be needed to bring out more ore.

Mine production of zinc in the United States during January totaled 43,610 tons (zinc content), or 10% short of equalling the average monthly output of 1949, the Bureau of Mines reports.

Tin Unsettled

The tin industry passed through a trying month. The RFC announced on March 13 that it has withdrawn as a seller of tin at fixed prices and will limit future transactions to average price business. This, in effect, removed RFC as a factor in establishing quota-

Average Prices for March (E&MJ Quotations)

Copper:	
Electrolytic Domestic, Refinery	18.200
Electrolytic, Export, Refinery	18.425
Lead:	
Common, New York	10.963
Common, St. Louis	10.763
Silver and Sterling Exchange:	
Silver, New York, per oz.	73.098
Silver, London, pence per oz.	63.957
Sterling Exchange, "Checks"	279.750
Zinc:	
Prime Western, East St. Louis	9.940
Tin:	
New York, Straits	75.694
New York, 99% min.	(e) 74.694
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$71.000
Antimony, (E&MJ) (d)	27.882
Antimony, bulk, Laredo	24.602
Antimony, in cases, Laredo	25.102
Platinum, refined, per oz.	$66.000
Cadmium, (a)	200.000
Cadmium (b)	207.500
Cadmium (c)	215.000
Aluminum, 99% plus, ingot	17.000
Magnesium, ingot	20.500
Nickel (f)	40.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange, checks, in cents. Quicksilver, per flask of 76 lb.
(a) Cadmium average based on the producers' quotation.
(b) Cadmium average based on the average of the producers' and platers' quotation.
(c) Cadmium average based on platers' quotation.
(d) Domestic, 5 tons or more but less than carload lot packed in cases, f.o.b. New York.
(e) Tin contained.
(f) F. o. b. Port Colborne, U. S. duty included.

tions, welcome news to the industry. The Tin Study Group convened in Paris on March 20 to draw up a plan to be submitted to the United Nations for international control. These developments combined to stiffen the market and by March 24 the quotation for prompt Straits quality tin moved up to 77¾c. per pound, New York. On March 29 the group voted nine to one to submit the draft of the control plan to the United Nations. The United States alone objected because the plan was viewed as weak in the matter of protecting the consumer. Thereafter prices declined, losing all earlier gains.

It was estimated that world production of tin in 1950 may total 172,000 long tons, with commercial needs at 127,000 tons. Unless the United States absorbs a large tonnage for stockpiling purposes the price situation, without control, will remain unsettled.

Antimony continued its downward trend. The leading interest reduced its quotation to the basis of 24½c. per pound, bulk, carload lots, f.o.b. Laredo, Texas. However, in the open market, there were sellers at even less than 21c. per pound.

An accumulation of foreign silver in New York and hesitancy on the part of buyers caused the price to drop below the 73½c. level for the first time in about seven months. The Bank of Mexico continued as a buyer of surplus home production of silver throughout the month.

(Continued on page 106)

Major Metals

U. S. DAILY AND AVERAGE PRICES

	Electrolytic Copper (a) Domestic	(b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis
Mar. 1950						
1	18.200	18.425	74.375	12.000	11.800	9.750
2	18.200	18.425	74.500	12.000	11.800	9.750
3	18.200	18.425	74.500	12.000	11.800	9.750
4	No Market	18.425	74.500	12.000	11.800	9.750
6	18.200	18.425	74.500	12.000	11.800	9.750
7	18.200	18.425	74.500	12.000	11.800	9.750
8	18.200	18.425	74.500	12.000	11.800	9.750
9	18.200	18.425	74.500	11.000	11.800	9.750
10	18.200	18.425	74.500	11.000	11.800	9.750
11	No Market	18.425	74.500	11.000	11.800	9.750
13	18.200	18.425	74.750	11.000	11.800	9.750
14	18.200	18.425	75.500	10.500	10.300	9.925
15	18.200	18.425	76.500	10.500	10.300	10.000
16	18.200	18.425	77.000	10.500	10.300	10.000
17	18.200	18.425	76.000	10.500	10.300	10.000
18	No Market	18.425	76.000	10.500	10.300	10.000
20	18.200	18.425	76.250	10.500	10.300	10.000
21	18.200	18.425	77.125	10.500	10.300	10.000
22	18.200	18.425	77.375	10.500	10.300	10.000
23	18.200	18.425	77.750	10.500	10.300	10.000
24	18.200	18.425	77.500	10.500	10.300	10.000
25	No Market	18.425	77.500	10.500	10.300	10.000
27	18.200	18.425	77.000	10.500	10.300	10.200
28	18.200	18.425	76.500	10.500	10.300	10.250
29	18.200	18.425	76.000	10.500	10.300	10.250
30	18.200	18.425	75.250	10.500	10.300	10.250
31	18.200	18.425	74.875	10.500	10.300	10.250
AVERAGES FOR MONTH						
Mar.	18.200	18.425	75.694	10.963	10.763	9.940
AVERAGES FOR WEEK						
Mar.						
1	18.200	18.425	74.167	12.000	11.800	9.750
8	18.200	18.425	74.500	12.000	11.800	9.750
15	18.200	18.425	75.042	10.833	10.633	9.821
22	18.200	18.425	76.625	10.500	10.300	10.000
29	18.200	18.425	77.042	10.500	10.300	10.117
CALENDAR WEEK AVERAGES						
Mar.						
4	18.200	18.425	74.354	12.000	11.800	9.750
11	18.200	18.425	74.500	11.500	11.300	9.750
18	18.200	18.425	75.958	10.583	10.383	9.946
25	18.200	18.425	77.250	10.500	10.300	10.000

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c. to 0.15c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West command a premium of 1.10c. per pound over the current market for the Prime Western; Special High Grade 1.25c.

Quotations for lead are for common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harman is for silver contained in ores and other unrefined silver-bearing materials, in cents and one-eighth cent fractions per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, and is usually one-quarter cent below the price paid for such bar silver, this deduction being the allowance for carrying, delivering, and marketing. In addition to foreign silver, the quotations also apply to domestic and Treasury silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

	Sterling Exchange "Checks"	Silver (c) New York	Silver (c) London	Gold London	Gold (d) United States
Mar. 1950					
1	279.750	73.250	64d.	248s.	$35.00
2	279.750	73.250	64d.	248s.	35.00
3	279.750	73.250	64d.	248s.	35.00
4	(e)	(e)	(e)	(e)	35.00
6	279.750	73.250	64d.	248s.	35.00
7	279.750	73.250	64d.	248s.	35.00
8	279.750	73.250	64d.	248s.	35.00
9	279.750	73.250	64d.	248s.	35.00
10	279.750	73.250	64d.	248s.	35.00
11	(e)	(e)	(e)	(e)	35.00
13	279.750	73.250	64d.	248s.	35.00
14	279.750	73.250	64d.	248s.	35.00
15	279.750	73.250	64d.	248s.	35.00
16	279.750	73.250	64d.	248s.	35.00
17	279.750	73.250	64d.	248s.	35.00
18	(e)	(e)	(e)	(e)	35.00
20	279.750	73.250	64d.	248s.	35.00
21	279.750	73.250	64d.	248s.	35.00
22	279.750	73.250	64d.	248s.	35.00
23	279.750	73.250	64d.	248s.	35.00
24	279.750	73.250	64d.	248s.	35.00
25	(e)	(e)	(e)	(e)	35.00
27	279.750	73.250	64d.	248s.	35.00
28	279.750	73.250	64d.	248s.	35.00
29	279.750	72.750	64d.	248s.	35.00
30	279.750	71.750	64d.	248s.	35.00
31	279.750	71.750	63d.	248s.	35.00
MONTHLY AVERAGES					
Mar.	279.750	73.098	63.957d.	—	35.00
AVERAGES FOR WEEK					
Mar.					
1	279.750	73.250	—	—	—
8	279.750	73.250	—	—	—
15	279.750	73.250	—	—	—
22	279.750	73.250	—	—	—
29	279.750	73.150	—	—	—

Calendar week averages, New York Silver: March 4th, 73.250; 11th, 73.250; 18th, 73.250; 25th, 73.250.

(e) No market (Saturday).

Behind the By-Lines...

G. P. Lutjen

» **Joseph M. Gambatese** finished the Mine-Mill story (p. 93) on his 38th birthday. He's been keeping a sharp eye on Mine-Mill since before the war, when he covered labor news for the *Cleveland Plain Dealer.*

However, following labor developments on Capitol Hill, in the Labor Department, Conciliation Service and NLRB for 12 McGraw-Hill magazines, writing a chapter for a new book on pensions, covering most of the big labor conventions, being vice president of Industrial Relations Research Assn., Washington Chapter, and serving as committeeman in the National Press Club, are only things Joe does when he is not playing golf.

His golf game was good enough for him to lead the qualifiers from the Baltimore-Washington area last summer for the National Public Links Golf championship. He got a trip to Los Angeles where, as he put it, "... I was licked by an AFL iron worker from San Francisco."

Joe has a running golf feud with Gov. Frank J. Lausche of Ohio. It began in 1935 when the governor was a city judge and Joe covered his court. "I could always justify an afternoon off for golf with him (the judge)—I was covering my 'beat,' even if it was on the golf course."

After looking over the Mine-Mill story in this issue, we harked back (and harking back hasn't been easy since we sprained a muscle in a pool game last fall) to E&MJ's July, 1947, story on communism in the mining industry. If you still have any doubt that Mine-Mill doesn't toe the party line, we still have a few reprints of that article which we will be happy to mail out while they last.

» **"What Is Best in Drilling Blastholes"** is discussed on page 86 by **C. H. Hopper.** When development of Steep Rock mine called for the diversion of Steep Rock Lake, the new course was designed to pass through a little body of water known as Raft Lake. A channel had to be cut to Raft Lake on the east and from Raft Lake to an existing lake to the west. The drilling for the east cut was done by churn drills. Drilling for the west Raft Lake cut was done by diamond drills under the direction of Mr. Hopper.

We are manfully refraining from saying that Mr. Hopper is well qualified to discuss drilling practice because he has a raft of experience.

» **We have always subscribed** to the notion that copper mining and smelting is an ancient and honorable profession. But it's always startling to realize just how ancient it really is. **S. E. Birgi,** whose article on Turkey's Ergani mine is on p. 92, has just reminded us. He writes that he has seen some recently excavated tablets which were contracts or business letters exchanged among the old Assyrian traders. From the matter of fact nature of their contents, Mr. Birgi is under the impression that copper smelting and trading were everyday business activities. The date is given as 2000-1800 B. C.

Since Ergani, which shows no appreciable zone of oxidation, supplied their ore, Mr. Birgi concludes that metallurgy practiced at that time was not a mere smelting of native copper or oxide ores, but included the process of roasting sulphides, a definite step forward in metallurgy.

Further notes on Ergani's biography show that the Assyrians worked the mine a little after 1270 B. C. In the 12th century A. D. the Arabs were running things. Under Turkish rule in the 16th century, miners and metallurgists were brought in from the famous lead-zinc mines of Laurium, Greece.

As the late Damon Runyon might have said, the Ergani mine is a little bit older than somewhat.

» **Without crystal ball** or turban you can now predict how much ore is left in your orebody before you find it. Sounds silly, doesn't it? But the method has been well tested on several porphyry copper orebodies in the U. S. Good headwork is required rather than black magic. **S. G. Lasky** of U. S. G. S. is the father of the idea (p. 83). (For his efforts along these lines, his colleagues in the Survey have tagged him "Swami Sam.")

Logically the idea seems sound if you realize that distribution of ore like other things obeying the law of chance, is subject to mathematical interpretation, and that all numbers behave in patterns. Toss a handful of coins on the ground and you can predict that half of them will turn up heads. You can predict that 6 out of every 36 rolls of the dice will be a seven. Which reminds us—there's a horse in the 4th race at Hialeah. Mr. Lasky, could you—? No. I guess you couldn't.

» **Interesting outcrops** from the departments this April are...a hydraulic brain to handle your drilling (p. 124)...a tab on steel shop foreman's method of driving jackstuds (p. 103)...a letter on behalf of less confusion in the rockburst department (p. 119) ...an Operating Idea in support of the old theory that it takes a heavy hammer to drive a good nail (p. 107)...and This Month in Mining features some glimpses at U. S. Steel's Cerro Bolivar (p. 128).

» **Alert readers** from various parts of the country have been informing us that we were a trifle over-enthusiastic last month in stating the depth of an oil well in Wyoming as 30,521 ft. For a lousy 10,000 ft., some of them were awfully critical. Furthermore, after some of the stories we have heard Texans tell, it's difficult to see why they, in particular, should be so upset by a slight exaggeration.

There are several courses of action open. We can (1) assume a how-do-you-know-we-haven't-got-inside-information attitude; (2) blame it on the printer; or (3) admit we slipped up. Anyhow, it will give our 201 Russian readers something to think about.

ENGINEERING AND MINING JOURNAL

APRIL, 1950

Have You Done Your Part?

DO NOT BE DISCOURAGED from doing your part toward obtaining a livable tax climate for mining by disbelief that the job can be done.

We insist that the mining industry has the strength to do this job, if everyone will only do his part. True, the mining industry does not muster enough massed votes to enjoy the "sacred cow" status of agriculture or organized labor. But it does have a broad geographic spread, considering the metals, non-metallics and coal. This, coupled with the great merit of its case for tax incentives, affords sufficient strength for effective results, *if the strength is utilized.*

Utilizing that strength means communicating with Congress yourself, and in your own words. It means persuading your business associates and fellow citizens to do the same. It means arousing the interest of women's clubs, and if you are part of a corporation management, letting your stockholders know what is at stake.

Most of the members of Congress are, like most of the rest of us, reasonably intelligent and well meaning. They simply do not realize what taxes are doing to the future of mining. If the problem is clearly explained by even a few people from "back home" whom the members know and trust, we are certain that Congress will respond.

Congress wants to safeguard our national security and well being. It wants basic industries to survive and provide foundations for future taxable income. Better than most of us, it understands the precious dynamism of competitive private-enterprise industry. It will protect the future of the mining industry if you will do your part in explaining how taxes are undermining that future. Urge adoption of the National Minerals Advisory Council's six-point program (E&MJ, Mar., p. 57). Don't let it be said later that the cause was lost because you wouldn't bestir yourself sufficiently to do your part!

Markets Are the Keys

DESPITE CONTINUED UPWARD pressure on production costs, the prices for the non-ferrous metals can hardly be called reasonable from the standpoint of domestic producers. When will prices be in sufficient balance with costs to reduce the fears which beset producers today and to bring the normal contingent of small operations back into production?

There are various elements in the picture which contribute to the present tendency of production to outrun demand, but which are accessory in their influence. The producer is faced with a Government-labor coalition based on the massed votes of organized labor, that frequently rides roughshod over local conditions which govern the capacity to pay wages. The foreign producer, because of devaluation, has a presumably temporary advantage in the U. S. market and because of dollar shortages, a particular incentive to sell in it.

But the most pervasive single influence in the metal markets today is the abnormally low consumption in the two greatest market areas outside of the United States, namely, Europe and the Far East. This condition affects domestic mining in two ways. It backs up metal and metal-bearing exports from the United States, and it causes abnormal foreign offerings to the U. S. market of metals that would otherwise be consumed abroad. If these foreign market places were taking their normal requirements, devaluation would be of academic interest only to domestic producers. If markets should shrink sufficiently to cause a real struggle for survival between the world's producers, devaluation would provide an important advantage to foreign producers.

The impoverishment of the Far East, due to war and civil disorder, seems unlikely to change for the better soon. Communist successes in China have encouraged renewed disruptive activity in Indo China, Korea, Burma, Malaya, and the East Indies. Also the possibility of war between India and Pakistan is not remote. A return to peaceful progress, conducive to improved living standards, is not in sight.

In Europe, consumption of the metals is abnormally low, despite the substantial shipments from

the Western Hemisphere financed by the Economic Cooperation Administration. This is due to a number of factors. Europe is divided by the Iron Curtain, which restrains the important trade normally occurring between eastern and western Europe. The economy of Europe is seriously affected by the low level of activity in its former industrial heartland, Germany; itself split in two between the East and West, and held down to a level of production dictated by the security aims of the conquerors. Trade involving European countries is greatly hampered by import duties and exchange controls. Productive effort is deterred by lack of confidence in currencies whose values are fixed at artificial levels by political authorities. In other words, European purchases for the foreseeable future will be controlled by purchasing power or exchange regulations, not by actual needs, which are much greater than Europe is likely to buy. With Russia standing by, ready to capitalize on any weaknesses in western Europe, the whole picture is exceedingly difficult.

This state of affairs is not only completely beyond any curative powers within the mining industry, but seems to be beyond the control of all the governments involved. In our opinion, the only basis which seems likely to encourage trade is to accept the verdicts of the market places as guides to currency values and to accept the discipline of convertibility to gold or silver.

Meanwhile, until and unless more normal currency relationships are established, along with other policies conducive to improvement of foreign living standards, our Government ought to be studying ways and means of preventing injury to domestic mining and smelting to an extent incompatible with national security and well being, by offerings in the domestic market of foreign metal at prices which domestic producers cannot meet. This might be done through applying the flexible provisions of the Tariff Act and the escape clauses of reciprocal agreements to offset the advantages which devaluation gives to the foreign competitor. It might be done by Government purchases, as long as tonnage objectives are in consonance with security plans. However, for the Government to pile up metals beyond security needs will provoke a situation likely to have serious after-effects.

The foreign producer is no more anxious to break his market than are sellers in general. Also, we should be prepared to share the domestic market with him to a reasonable extent. But if he should be forced by distress conditions to make offerings in this market which bring prices down to levels ruinous to domestic producers, the latter are entitled at least to protection offsetting the special advantages to foreign competition resulting from devaluation. Government has had a big hand in bringing about the conditions which handicap the domestic producer. He naturally looks to the Government to bail him out if conditions get completely beyond his control. Also, in the final analysis, it is the average citizen who is principally concerned with maintaining domestic mineral industries in this country large enough for national security and for protection of our consumers against combinations to force prices up.

Help the Technical Graduate

WE ARE INFORMED THAT, in contrast to the situation in recent years, jobs for technical graduates in mining are rather scarce. Considering that the number of young men who have aimed their hopes at the mining industry is quite limited, this apparent scarcity of opportunities is unfortunate.

The mining industry has a real interest in preserving a reputation for opportunity that will attract its fair share of the abler young men into schooling adapted for mining employment. Inevitably, technical graduates will form a large share of the industry's future key men, thus the quality of young men who are now selecting mining for a career will have an important influence on the tempo of the industry's future progress. If these who are now graduated have a hard time finding jobs, it discourages younger lads from selecting mining as a career.

A considerable portion of the current crop of graduates is composed of ex-GIs, whose opportunities for schooling were deferred by war service. It would seem particularly deplorable if these veterans, after their war service, their lost years, and after taking the time to acquire specialized education, should find themselves rejected by the industry of their choice.

If there were an actual surplus of engineers in the mining industry or training for it, the proper remedy would be to discourage the training of surplus talent. However, nothing we have observed leads to any such conclusion. On the contrary, our belief is that more and better engineering is a real need of the industry. But few if any organizations are utilizing the full potentiality of engineering as a cost-cutting function.

Therefore, we earnestly hope that those able to provide jobs will extend themselves to give the current crop of graduates a chance to demonstrate their worth. The real beneficiaries will be the organizations which compose the mining industry in the years to come.

Mine, Mill vs CIO Fight Means Turmoil For Mining

This is what the CIO's ouster of the Mine, Mill and Smelter Workers Union means to management in metal mining

▶Communist influence in metal mining is declining. The CIO wants to wipe it out, but leave metal mining with no union of its own.

▶Philip Murray's CIO Steelworkers could absorb nonferrous mining, too; thus smother metal mining in a giant union of great political and economic power.

▶Big mining companies, tied to steel, would lose much of their identity in bargaining. Small mining companies could only hope for the best, take whatever came.

▶Management's best hope lies in maintenance of agreements with non-Communist leaders in locals not tied to big unions outside metal mining.

JOSEPH M. GAMBATESE
McGraw-Hill Washington Bureau

AS A READER of this magazine, you have some direct connection with, or strong interest in, the metal mining industry, and its labor relations. Perhaps your company has a contract with the Mine, Mill and Smelter Workers union. Or perhaps you bargain with a local that pulled out of Mine, Mill in the past few years.

But whatever your situation, you probably asked yourself these questions when you heard that the CIO had expelled the Mine, Mill union:

"What does it mean to me? What does it mean to the industry?"

It's worth your while to consider the answers to these questions, because the battle looming up in the metal mining industry will inevitably affect you and your organization. This article was written to help you decide just how, and how deeply, you will be affected.

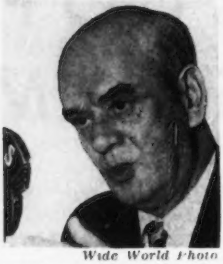
The outlook for metal mining has been summarized very briefly above. Here are a few more of the details:

- Although Communist influence in mining labor relations will be reduced considerably, intra-union strife will intensify. The CIO United Steelworkers of America has already absorbed many former Mine, Mill locals. The steel union will attempt to move in on other large segments of the industry. As one Mine, Mill official put it, "When we are raided, we fight back."
- The mining industry's wage settlements eventually may be subordinated to those of big industries like steel. The CIO's aim is to leave the mining industry with no union of its own. The CIO wants to wipe out Mine, Mill, and believes that it will break up in about this fashion:
- Right-wing locals in the West, Midwest, and the South will join with the Steelworkers, CIO President Philip Murray's own union. About 25 locals with 20,000 members in Utah, California, Nevada, Illinois, Indiana, Pennsylvania, and Alabama have already swung over to this union. Most of these had already seceded from Mine, Mill, and had signed up with the Progressive Metalworkers Council, an affiliate of the CIO Shipbuilders union. Ship has now dissolved PMC, and its former locals have nowhere to go but into Steel, the Ship-

Mine, Mill vs. CIO—The Leaders . . . . . And Their Lieutenants

Wide World Photo

MAURICE TRAVIS, Mine, Mill boss, will fight Steelworker raids bitterly, but will be following Party line to end, so he has said.



Wide World Photo

PHILIP MURRAY, Steelworker leader, says he plans no attack on Mine, Mill. Yet all signs point to real battle over miners.

GRAHAM (COZY) DOLAN, hard-boiled Party liner, handles "education" and propaganda for Mine, Mill. He's very good at it.

CIO Photo

CHARLES MILLARD, Murray man from Canada, may direct the Steelworker assault on Mine, Mill. He's tough, capable.

builders, or the CIO Autoworkers.

● John Driscoll, who led the original bolt from Mine, Mill in Connecticut's Brass Valley, hopes to take 17 former PMC locals into Walter Reuther's Autoworkers union. If he gets his wish, Driscoll would head a copper and brass council within the Autoworkers union. He would thus retain his identity in CIO, and hold his "status" in labor's political circles. He couldn't do that in the Steelworkers union, because Philip Murray will not divide his union into separate groups or councils.

● The score of locals in metal casting plants that pulled out of Mine, Mill some time ago will remain in the Autoworkers as a separate "Casting Division." This group is headed by Kenneth Eckert, onetime director of Mine, Mill's Castings Division. Eckert, a former Communist, split with Mine, Mill over the latter's refusal to sign Taft-Hartley non-Communist affidavits. Mine, Mill, of course, had to sign later on in order to hold the union together.

● Outside the CIO, the International Association of Machinists (Independent) and the AFL will be organizing actively to try to pick up at least a few of the Mine, Mill locals. Mine, Mill, of course, will be around for quite awhile. It will be weaker, but it may join up with other CIO outcasts to form a left-wing union group of some kind. This isn't likely, however.

● Lastly, John L. Lewis has put out some feelers toward the Mine, Mill group. He has offered them a haven, if that word can be so loosely applied, in his catch-all District 50. Lewis worked closely with Communists in his early days with the CIO, even though he later broke with them. Significantly, both the Communist *Daily Worker* and Mine, Mill's publication, *The Union*, have been saying nice things about John L. They cite him as a fine labor leader, in contrast with Philip Murray, Walter Reuther, James Carey, Adolph Hitler, Tom Girdler, and other notorious union wreckers and reactionaries (in the Communist view.) It would be a surprise, however, if Mine, Mill found a home with Lewis.

Mine, Mill remains strong in some places like Idaho and Montana, where the parent Western Federation of Miners was founded in 1893. It will be hard to displace Mine, Mill in some of the large Western operations of Anaconda, Kennecott, Phelps Dodge, and American Smelting & Refining.

At Garfield, Utah, for instance, Wesley Madill, former western vice president of Mine, Mill, has been a leader in PMC's fight on the union. Yet he did not swing his PMC smelter local over to the Steelworkers. This local and a few others are still PMC, or rather in the Shipbuilders union, because PMC as such no longer exists. Men in these locals want a metal mining union somehow, even Mine, Mill.

Will Murray Fight?

How aggressively will the steel union move into mining?

If you believe what Murray's aides tell you, they will not lift a finger toward bringing mining under the Steelworker's banner.

"We have only told the Mine, Mill locals that they may affiliate with whatever CIO union they wish," David J. McDonald, the union's handsome, pipe-smoking secretary-treasurer, will tell you. "If they ask us for a charter, we will issue them one." Nothing warlike at all.

A good guess, though, is that the Steelworkers will put on a good, stiff organizing drive. All unions want to grow larger, stronger. In this particular situation, Murray has a special responsibility for keeping as many Mine, Mill locals as possible in CIO. As president of CIO, he must bear the major burden of the impact of losing more than 500,000 CIO members in Mine, Mill and other unions. It falls naturally, then, for Murray's steel union to spearhead the CIO drive in metal mining. Besides, the union already has a start in iron mining, where the Steelworkers bargain for 15,000 men in Minnesota and 5,000 men in Alabama.

When the CIO cut off Mine, Mill last Feb. 15, it brought to a climax a 10-year-old left-right tug-of-war within the union. It began during the defense period before the war when the Mine, Mill leadership opposed America's foreign policy of aid to Britain. This was the position of the Communists, too, because Russia at that time had a non-aggression pact with Hitler.

After we got into the war, John Driscoll of Connecticut tried to defeat Robinson for president of Mine, Mill, but lost. The smoldering resent was kept quiet during the war when our aims coincided with those of Russia and the Commies became superpatriots.

With the end of the war the situation reverted back to what it had been before. Mine, Mill leaders again turned against American foreign policies because they conflicted with Communist objectives. Fed up, Driscoll and his coterie of supporters made another attempt to unseat Robinson by running James J. Leary against him at the Cleveland convention in 1946.

Again this group failed. This time they charged that election

These men may help split up Mine, Mill

WESLEY MADILL, old Mine, Mill officer, led Utah group out of Mine, Mill, but not into steel. He's an independent at present.

Wide World Photo

JOHN DRISCOLL led fight on Travis, now hopes to get his Conn. brass locals into CIO Autoworkers as new council.

KEN ECKERT, reformed Communist, took Mine, Mill's Casting Division into Autoworkers some time ago as separate unit.

THE OLD MAESTRO looms in the background. Lewis has offered Mine, Mill's left wingers a home in his District 50 union.

irregularities had kept Robinson and his supporters in power. In disgust, Driscoll led a secession movement out of Mine, Mill. Eventually, some 40 locals banded together as PMC and affiliated with the CIO shipbuilding union.

CIO could not ignore the serious breach in Mine, Mill. It appointed a three-man committee, headed by Jacob Potofsky, president of the Amalgamated Clothing Workers, to investigate the situation.

This committee recommended: that: 1, Driscoll be removed as secretary of the Connecticut CIO; 2, Maurice Travis who had replaced Reid Robinson step down from the presidency pending another election; and 3, the PMC charters issued by the shipbuilding union be withdrawn. Mine, Mill leaders would not comply.

(For more details on Mine, Mill developments up to this point, see "Communism Menaces the Mining Industry," *E&MJ*, July, 1947.)

The breach was widening. In a gesture toward closing it a bit, John Clark, secretary-treasurer, had been put in as president of Mine, Mill. Travis stepped down to secretary-treasurer, thus in a sense fulfilling part of the CIO committee's recommendations. Clark was not suspected of Communist ideologies, but he was considered a good "front" for Robinson and Travis; a person they could "control."

Meanwhile, Taft-Hartley had become law in July. Along with other CIO unions, Mine, Mill decided against signing non-Communist affidavits. This raised some problems later when some of the CIO unions, particularly Reuther's auto workers, complied with the law and took advantage of Mine, Mill's inability to get help from the National Labor Relations Board. By the summer of 1948 the situation was beginning to pinch. (See "Why Deal With a Union Influenced by Communists?" *E&MJ*, May, 1948.)

Eckert tried to get Mine, Mill leaders to comply also so as to save the castings division from decimation by the auto workers and other unions. His plea fell on deaf ears. So, in June, 1948, he led 24 locals with 20,000 members out of Mine, Mill and into UAW-CIO.

This intra-CIO warfare got hotter. Bitter strikes hit plants of American Zinc, Lead and Smelting Co. and Precision Castings Co. in various parts of the country. Some companies stood firm, finally won out, ridding themselves of Mine, Mill. (See "Communists Still Threaten Metal-Mine Labor Relations," *E&MJ*, April, 1949.)

A full break with CIO was in the making. Mine, Mill began holding back its per capita tax payments to CIO. It owed $55,000 when the CIO convened at Cleveland last fall.

While the CIO convention did not expell Mine, Mill outright, it put the wheels in motion for just that eventuality. Charges were filed against Mine, Mill and a committee appointed to hear them.

How Reds Worked

Again Mine, Mill found Potofsky at the head of the committee. This committee heard a sordid story of a "secret apparatus" that operated within the union as a Communist "transmission belt." (See *E&MJ*, March, 1950.)

Most important witness was Eckert, who as a Communist at the time was part of this "secret apparatus." He said that he and Travis were on a four-man Communist "steering committee" in Mine, Mill. They organized a "progressive caucus" in the union which included all the Communists and those sympathetic to them. This caucus was able to plot strategy and make policy decisions in advance of regular Mine, Mill meetings. They had little trouble putting their program across.

The "steering committee," according to Eckert, met frequently with such top Communist leaders as William Z. Foster, present national chairman of the Communist Party of the United States; Eugene Dennis, national Communist secretary, and John Williamson, Communist labor secretary.

Eckert and Homer Wilson, former Mine, Mill vice president, told the committee how these outside Communist leaders decided, for instance, that Robinson had to step down after a mistake of his had embarrassed the union. They decided too that Travis' Communist sympathies were too well known for him to function effectively as president, and that it would be better to have a man like Clark in the top post.

In finally recommending expulsion, the CIO committee stressed that the decision was based not on the fact that some Mine, Mill leaders were Communists. Rather, it was because they let Communism, the enemy of free labor, interfere with the carrying out of true trade union objectives.

New Contracts Coming?

As the jurisdictional fight accelerates, more questions will arise as to the status of union treasuries and union contracts. Local treasuries are a union, not management, problem. But management is directly involved, and interested, in what happens to existing labor contracts. Most of the big mining contracts signed last year run for two years, until next year. Some run longer.

What happens to these contracts?

There are two parts to this question:

First, does the contract stand in the way of a change in union affiliation?

Secondly, if there is a change in unions, is the union entitled to negotiate a new contract?

Experience has been that, where there is clear evidence of a change in union affiliation, NLRB will permit a bargaining-agent election to be held even though a contract may have another year or so to run. In the electrical industry, for instance, NLRB took cognizance of the expulsion of the UE by the CIO convention and the chartering of a new CIO electrical union. The vote of a local union to switch from Mine, Mill to steel or some other union also would carry great weight with the labor board.

To protect yourself under Taft-Hartley, it is best to insist that any new union obtain certification from NLRB. You may file a petition for an election if the union doesn't.

Courts May Decide

On the second question, opinion is divided. There are no precedents either under the Wagner Act or Taft-Hartley. Usually the question of a contract's legality is decided in the courts if the employer and the unions affected cannot reach some mutual understanding.

According to one view, a labor agreement is negotiated for the employees by their bargaining agent. It belongs to the employees. There has been no change in employees. They should not be able to rescind an agreement merely by switching to another union.

Another view holds that a labor agreement is between the employer and the union. Once the union is out of the picture, the agreement is dead. It can't operate with only one party.

In some situations it may be urgent to get immediate clarification of this point. That is when the contract contains a check-off.

Suppose, for instance, that your local switches from Mine, Mill to the Steelworkers. And your contract calls for check-off of dues to Mine, Mill until June, 1951. What will you do if Mine, Mill keeps on collecting the check-off?

Many employers have found this way out of that dilemma: Put the check-off deductions in escrow and let the unions go to court to establish their right to the money. A new check-off authorization from individual employees may be necessary to meet the Taft-Hartley requirements.

A Word Of Caution

What Joe Stalin does will have less effect on what the labor leader on the other side of your bargaining table says or does from now on.

But what you will be reminded of soon, though, is that mining's new labor leaders stand four-square behind the Truman administration's Fair Deal domestic policy. More important, Murray, Reuther & Co. have a hand in framing that policy. They play an even bigger part in trying to put it through Congress. They have real influence in Washington; Mine, Mill never did.

This will be felt at the bargaining table. Through their political machines, these unions influence the President and Congress, particularly in election years.

The steel union concentrates its bargaining power at the top. A 200-man wage policy committee with elected representatives from all the districts decides what new demands will be pressed. This decision is usually directed by Murray and his executive board composed of the union's national officers and district directors.

Ostensibly, committees at each of the companies "bargain" on the demands. The real decision, however, is made by Murray with one company. Usually it's U. S. Steel. Last year it was Bethlehem.

A contract is signed. Copies go out to the union's bargaining committees at other companies. They hand it to the employer on a "take it or else" basis. That's "pattern" bargaining.

Pattern Bargaining Now

The union will deny that it forces the same contract on all employers. A leader told me that a "pattern" contract is sent out to the steel locals with advice to "get the best contract you can using this one as a basis."

True, there have been deviations. But they are rare exceptions to the rule. More often than not the deviation is in the union's favor, a better contract than the "pattern" settlement.

Under compelling circumstances, the steel union has been known to accept less than the "pattern" where the employer can justify it on the basis of his particular business situation. In some cases, the union has taken extraordinary steps to assist an ailing company get back on its feet. It has accepted deferred wage increases, or waived them entirely. But the circumstances must be compelling.

In some ways this "pattern" bargaining is worse than industrywide bargaining. The small employer, who may have a small voice in industrywide negotiations through representation on the bargaining committee, usually has nothing at all to say about a "pattern" settlement. This situation confronts even some big companies. How much did Jones & Laughlin have to say about Bethlehem's settlement with Murray? Nothing. Yet it had to take the same thing later.

The steel union is able to, and usually does, pull all its members on strike at the same time. This is done by fixing the same expiration date on contracts or by waiting until all contracts have expired, or permit strikes before calling one.

Trouble Ahead

The international union, headquarters in Pittsburgh, makes itself a party to all contracts signed by its locals. It must approve them before they can become effective. Steel union members are members of the international union, not of a local union. They are assigned to local unions only for housekeeping purposes and may move freely from one local to another.

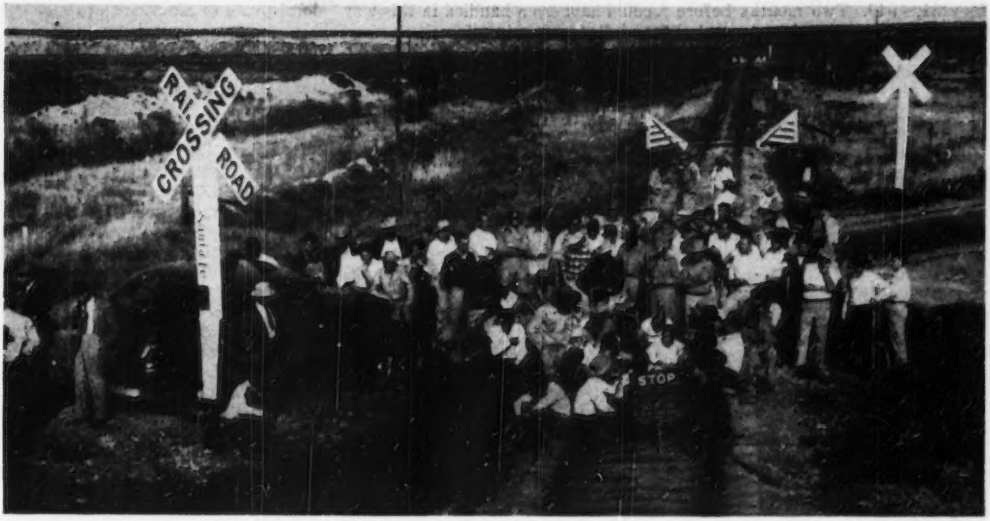
In these ways the steel union is able to keep strong, centralized control over the activities of local unions at the expense of individual, particularly the smaller, employers.

The union will try to extend its wage policies in steel to the mining industry. You'll hear a lot about the $100 non-contributory pension. Soon the union will be thumping for a guaranteed annual wage.

Financially, the Steelworkers are the richest of all the CIO unions. The union has $7,600,000 in liquid assets, half of it in cash. Without stopping for a deep breath, Murray signed a $500,000 gift check for the striking coal miners. (Lewis returned it, offered a "loan" of $1,000,000 to the Chrysler strikers.)

A mining industry of about 160,000 employees would be linked to a union of close to a million members. It would be outnumbered and outweighed, 10 to 1. Odds against the industry having a major voice in determining wages and other labor relations policies which affect it would be worse than that.

The individual employer? He would be lost in the shuffle.



PICKETS BLOCK SANTA FE TRACKS into Carlsbad's potash plants. Begun without justification, and ending in failure, strike exposed basic shortcomings of union leadership's divided loyalties.

The Carlsbad Strike

How A Mine, Mill Local Paid Heavily For Its Leaders' Mistakes

THE TRUTH ABOUT the strike called recently at Carlsbad by the Mine, Mill and Smelter Workers Union makes these points crystal-clear:

1. No reasonable basis whatever existed for this costly 74-day strike.

2. Rank-and-file members suffered needless hardship through the short-sightedness and divided loyalties of their leaders.

3. The Mine, Mill leadership, despite its disregard of the best interests of its Carlsbad members showed surprising power to sway and control the workers.

4. The mining industry as well as all industry, badly needs labor statesmen, not labor bosses.

Background for study of the strike at Carlsbad is set admirably by Mr. Gambatese' report in these pages of the expulsion of the Mine, Mill union from the ranks of the CIO.

The union had been under CIO's fire for sometime. There had been talk of expulsion long before the strike began in November. It may be that the Mine, Mill leaders thought a successful strike would strengthen their hand in the coming showdown with CIO. It may be, too, that there was some hope of hampering European recovery by crippling the vital fertilizer industry. Whatever the reason, the strike was long, bitter and expensive.

Operations in the Carlsbad, New Mexico, potash area are at present conducted by three companies. In order of their establishment, they are United States Potash Co., Potash Company of America, and International Minerals and Chemical Corp.

Importance of Carlsbad

These three companies account for over 80% of all the potash produced in this country. Although before World War II, half or more of all potash consumed in the United States was imported, in recent years virtually all of domestic demands have been satisfied by American potash companies. In addition, the needs of some countries such as Canada and Cuba, are also taken care of by U. S. producers.

When it is considered that over 90% of all potash produced is used in agriculture, and that it is one of the three major plant foods, (with nitrogen and phosphorus) which are absolutely essential to plant life, it becomes apparent that any sustained stoppage of Carlsbad operations would inevitably have an effect on the nation out of all proportion to the actual dollars-and-cents size of the industry.

At each of the three properties there are three unions representing different bargaining units. The International Brotherhood of Electrical Workers (AFL) represents the electricians, and the International Association of Machinists (independent), various mechanical groups at International Minerals and Potash Company of America. At these two properties these two unions are very definitely minority groups. However at U. S. Potash Co., the I.A.M. represents all plant (refinery) workers, as well as a few mechanics at the mine.

The Mine, Mill and Smelter Workers union, Local 415 is, or was, the majority group, as it represented almost all of the underground workers at all three plants, as well as most of the surface men at I.M.C.C. and P.C.A. It spoke for about 1,600 men.

All contracts were open for negotiation, on basic wages only, on

May 31, 1949. Two months before that time the three unions presented their demands and negotiations began. As usual, the Mine-Mill group started their "bargaining" with a strike vote from the membership.

All three unions asked for higher wages. The companies took the position that earnings were already the highest in any industry ($2.05 per hour, $4,200 per year, average for hourly men), the cost of living was decreasing, and that no increase was justified. In addition, the employees were already enjoying pension, insurance and health plans superior to those under discussion in other industries.

Other Unions Sign

The I.B.E.W. and I.A.M. unions objected to the company statement that the cost of living was probably going down over the next year, and said that in their opinion it was going up. The companies said that they would agree to a clause stating that every full point rise in the B.L.S. index above 170 would call for a one-cent increase in basic wage rates, with no corresponding deduction in case of decreases in the index. The I.A.M. and I.B.E.W. agreed that this was a fair arrangement, and signed contracts May 30th and 31st, respectively.

The Mine-Mill union would have nothing to do with any cost of living adjustment, and maintained their original demand for a flat 25c. per hour increase. The contract year expired May 31, and work continued with no indication of when a strike might come. Meetings with Mine, Mill continued into June, but got nowhere.

An uneasy peace prevailed for some months, punctuated by attacks by Mine, Mill upon the companies, for alleged violations of contract conditions, for alleged company plans to reduce gains in seniority systems, and other moves which the union said the companies were making or planning. It was stated that working conditions were being worsened, that rigorous educational, age, and physical standards were being imposed. In general Mine, Mill pushed the idea that the men might have to strike to maintain their position against company encroachment.

There was, of course, no real reason why grievances should have held any importance in this dispute. All the companies had well established, simple grievance procedure, leading to final arbitration. Any of the "issues" alleged by the union could have been handled in this way and disposed of in a few days. None was, however.

Nevertheless, the situation was most skillfully developed by the union, and many of the men were convinced that they were being or were about to be abused by the companies. No one should underestimate the ability of this type of union to sway and control its membership.

On Nov. 14, 1949, representatives of Mine, Mill met with those of the three companies, with Rufus G. Poole as spokesman for the latter. The union maintained its demand for 25c. per hour increase; the companies continued their position that the increase was not justified. A conciliation commissioner, Mr. Walter White, came in and sat in sessions on the 16th and 17th. Nothing was accomplished at these late sessions.

At 7:00 a.m. Nov. 19 the union struck all three plants. The strike continued until Jan. 31, 1950. The companies cancelled their contracts with Mine, Mill on Nov. 23.

Of course, various things developed quickly. One of the early moves of the union was to mass men on the tracks of the Santa Fe Railway to prevent train movements into and out of the plants. This was stopped by a Federal court temporary injunction, later made permanent, which was violated and led to contempt proceedings, still unfinished. The railroad track picketing ceased.

Mass Picketing Fails

The union also massed men in front of the gates of the company plants, preventing all employees and other persons except salaried employees from entering the plants. All vehicles were stopped by the pickets, and only those which they wished to let through were allowed to proceed. The companies brought unfair labor charges for illegal picketing and other acts, against the union. The union brought counter charges.

In order to carry on needed repair and maintenance, the companies asked the machinists to report on Dec. 12. This they tried to do, under their contracts, but were blocked by mass pickets. A similar call to the electricians on Dec. 19 had the same result.

The general policy of the National Labor Relations Board is not to interfere in cases where illegal picketing is charged. The Board's contention is that these are for the local peace organizations to handle. However, when it appears that a critical situation which may bring about a national emergency develops, the Board may take action. It was rapidly becoming evident that a prolonged strike in the Carlsbad potash basin could cause such a crisis in agriculture. Investigations of the Board convinced Robert Denham, the general counsel, that this was the case.

The question then arose, could a substantial amount of production be resumed if the companies were allowed access to their plants through legal picket lines. The companies replied that it could, through the use of supervisors and non-striking employees.

Meanwhile, the Board had been investigating the charges filed by the companies and it is clear that this investigation was done thoroughly and diligently, without regard to the personal comfort of the Board's representatives, who worked almost around the clock. They concluded that there had been violations of Section 8(b) (1) (A) of the Labor Management Relations Act, and on Jan. 9, 1950, issued a complaint against the union. This was followed by request for an injunction in Federal District Court, granted Jan. 10, 1950.

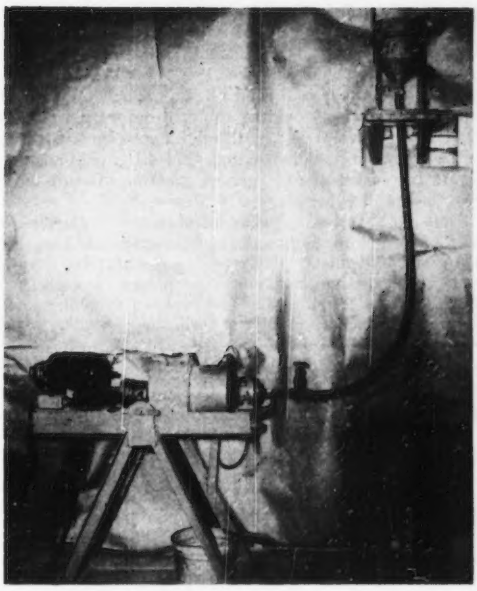
This had the effect of permitting anyone who wished to enter the plants to do so, without violence from the picket lines, and subject only to the comment and compliments of the individuals on the lines. The Board kept its representatives on the spot, not only to police the union, but as was specifically stated, to crack down upon the companies if they committed any unfair practices.

The non-striking unions, (machinists and electricians) were called back to work Jan. 12 and reported. On this same date all the companies made a final offer to the Mine-Mill union; essentially to reinstate the terms and conditions of the old contract.

Work Is Resumed

On Jan. 13 the companies issued a call to return to work, stating that plants would start producing Jan. 16, and giving strikers until Jan. 23 to return to work. A comparatively small number returned the first day and by the 23rd there were many still out. The companies meanwhile had been operating and producing potash. As they had announced they would do, they started

(*Continued on page* 80)



SMOOTH OPERATION, easy cleaning, low construction cost, accuracy and adaptability feature this improvised . . .

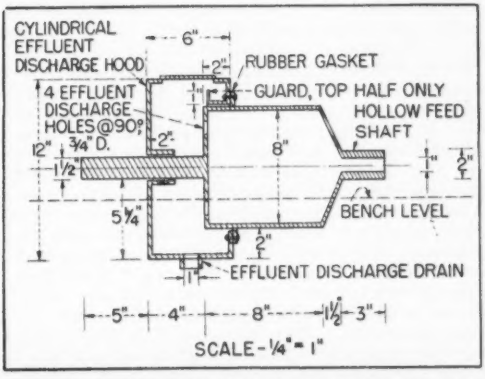
Batch-Test Centrifuge

EARL L. H. SACKETT*

Malvern, Ark.

IN OUR LABORATORY WORK at Malvern on samples of barite ores, we needed a centrifuge that would give us the same results on small samples that we could expect to get on the Bird centrifugal deslimers we use in the Magnet Cove mill. The centrifuge described in this article was the result.

*Asst. division metallurgist, Baroid Sales Division, National Lead Co., Malvern, Ark.



CROSS-SECTION THROUGH CENTRIFUGE shows how feed enters at right, separation takes place in central cylinder, slimes flow out into stationary hood at left.

We designed the centrifuge and had it built in a local machine shop. It cost us relatively little to make and it is simple to operate. As far as we know, this machine is unique in its low cost, ease of construction, and adaptability to laboratory problems involving desliming.

This centrifuge is strictly a batch machine, but its results agree quite closely with those of large continuous flow centrifuges. We get effective separation very quickly of minus 5 and 10 micron material in undispersed pulp. The machine uses only the principle of accelerated gravity settling common to all centrifuges.

The machine is shown in operation and in detail in the accompanying photographs and drawings. Completeness of separation at a given size fraction depends on the number of successive times, usually two to four, the sample goes through the machine.

Size of fraction that overflows depends on the speed of rotation of the cylinder and is, of course, inversely proportional to the speed. Rate of feed, which governs retention time, also has some effect on size of material overflowed.

Our machine can be run at three cylinder speeds: 1,000, 1,700, and 2,600 rpm. A greater variety of speeds could be provided by electrical control or by a Reeves-type drive.

To make a separation, the cylinder is first filled with water, through the feed line, while it is revolving at the chosen speed. Then the feed line valve is closed, and the pulp sample is placed in the feed tank. Air escaping back through the feed line keeps a finely-

TABLE I. Typical separation made on undispersed pulp ground to about 90% minus 325 mesh. Figures are all percent weights. Effluent made up 23% of weight of feed.

Micron Size	Rejected Effluent	Retained Product	Weight Rejected
Plus 15	8.6	50.2	4.9
—15 plus 10	3.8	16.1	7.2
—10 plus 7.5	5.1	12.3	11.2
—7.5 plus 5.0	15.0	10.6	30.0
—5.0 plus 2.5	24.4	6.1	54.8
Minus 2.5	43.1	4.8	73.1

ground pulp sufficiently agitated to prevent sanding up.

The feed valve is opened wide and the separation takes place rapidly. The effluent, containing rejected slimes, is collected in a bucket.

After the motor is turned off, the bucket under the effluent discharge should be changed before the cylinder stops. Material held by the cylinder is then washed out, as shown in the photograph. The other photograph shows the centrifuge in running position. Details appear in the drawing.

Data on a typical separation, made on undispersed pulp of an ore ground to about 90% minus 325 mesh, are given in Table I. The machine ran at 1,700 rpm., and the separation, requiring four passes through the machine, took 20 minutes. The rejected effluent made up 23% of the weight of the feed.

The Carlsbad Strike *(Continued)*

hiring permanent replacements after Jan. 23, and had no trouble obtaining men.

The union meanwhile had turned out in force on the picket lines, some over a mile long on each side of the roads, with women and children picketing with the men. Men first massed at the points where buses picked up their passengers for the plants and then drove out to the lines.

On the radio, in the union hall, by mimeograph, a continuous campaign of vilification and misrepresentation was kept up. Comparisons were drawn between the company executives and Hitler, Mussolini, and Judas Iscariot, at various times, each of these three showing up quite well by contrast.

As to producing potash, the union said the companies could not do it. Mine, Mill claimed the activity at the shafts, in the plants, and on the Santa Fe Railway was all phony and staged and no ore was being mined or treated.

The companies kept the strikers informed day by day as to what was going on and how many new men, permanently replacing strikers, had been hired.

By Jan. 31 over 300 new men had been hired by the three companies. It had become evident, even to the union's officers that the strike was broken. They capitulated on that day. The men started back to work the next day, after 74 days of striking, with no changes in the general terms and conditions of the old contract, which had been offered the union last April.

Many old employees lost their employment. The union tried to insist that all be reinstated before calling off the strike, but the companies, of necessity refused since the new men had been hired as permanent replacements. Many others had to start at the bottom, having lost top jobs and all seniority. This is in most cases very regrettable, but the companies explained in detail what was going to happen if the men stayed out. The union fought with every available weapon, and considering the complete lack of any reasonable basis for a strike, did a surprising job.

The tone of their publicity is illustrated in excerpts from a speech by Orville Larson, vice president of the union, Jan. 31.

> "Last night it was my job to tell the striking members of Local 415 that it was my opinion and the opinion of their elected negotiating committee that our strike must come to an end today. That our strike had been broken.
>
> "What was it that led these companies down the path they have followed for the past five months? What was it that led them to betray their obligations to the nation and endanger the whole country's food supply? What was it that led them into open defiance of the laws of the United States in refusing to engage in collective bargaining in good faith?
>
> "We said before the strike ever began and we have said it ever since, that the thing that led these companies down this road was a burning hatred of the men who create their profits. It was a blind and vicious desire to smash the union organization which these men had built for their own protection. These are the things that brought about the strike. These are the things that the companies had constantly in mind and these are the very things that the companies have been unable to do. I said this morning and I said this to the newspapers and radio reporters clear across the Nation, that this strike was broken, not by the potash companies, but by the agents of the United States Government. Yes, when the potash companies saw that they could not smash this union they were able to enlist every agency of the local, state and national governments in one of the blackest, most scandalous conspiracies America has ever seen.
>
> "We could withstand every thing these companies could throw at us but we could not hope to cope with the full fury of the combined forces of local government, armed police and Federal Government agencies. We charged just a week ago that these companies in conspiracy with Government agencies would not hesitate to commit murder if necessary to break this strike."

As this is written, all companies have returned to normal operation and production, and evidences of resentment on the part of returning strikers toward the men who came back to work before the end of the strike and those newly hired, have decreased substantially. No doubt the resentment will persist in some cases, even though it may not be shown. One would think that such feeling would logically be directed largely toward the union.

The companies have made their positions clear that there will be no discrimination nor hard feelings against the returned strikers, and in general the situation is satisfactory.

How Tonnage and Grade Relations Help Predict Ore Reserves[1]

Julian W. Feiss, Assistant to the Director, U. S. Bureau of Mines, carefully reviewed this stimulating article, and here is what he concludes in part: "Considering the wide application of modern statistical methods to other branches of science, the geology of ore deposits appears to offer a fertile field of investigation. Mr. Lasky's concept of the relationship between tonnage and grade in certain mineral deposits is by no means startling to the theoretical scientist. However, many geologists and mining engineers will be surprised to find out that such a relationship can exist. . . . If Mr. Lasky has done nothing else, he has pointed out to the mining geologist the importance of applying the tools of mathematics to his science."

Our own conclusion is that Mr. Lasky's article will compel you to speculate whether the tonnage-grade history of your mine can't help predict reserves beyond those already proven.—The editors.

S. G. LASKY[2]

Part I—Why Mathematical Laws Apply to Oré Deposits

DISCHARGE A SHOTGUN at a target. The pattern of holes within the circles of the target might be called a standard pattern of dispersion or frequency. Mathematically it can be expressed in several ways. If the number of holes in each circle is compared with the number of holes in adjacent circles, the equation describing the pattern has a definite form, commonly known as the Gaussian or normal equation of probability. If the target is small, so that some of the shot missed it, the number of holes that the outer circles of a larger target would have contained can be easily calculated.

Likewise, nature seems always to operate in an orderly fashion, never haphazardly, even though man has chosen to tag some of her actions as "random." Moreover, in the pleasing phraseology of D'Arcy Thompson,[3] "Nature rings her many changes on a few simple themes. The same expressions serve for different orders of phenomena. The swing of a pendulum, the flow of a current, the attraction of a magnet, the shock of a blow, have their analogues in a fluctuation of trade, a wave of prosperity, a blow to credit, a tide in the affairs of men. The same exponential curve may illustrate a rate of cooling, a loss of electric charge, the chemical action of a ferment or a catalyst."

In a recent paper[4] I implied that these same principles apply to the distribution of mineral in some ore deposits, as follows:

"In many [mineral] deposits in which there is a gradation from relatively rich to relatively lean material, there appears to be a consistent mathematical relation between tonnage and grade, according to the equation . . . Grade $= K_1 - K_2$ log tonnage. The equation seems to apply . . . to such widely diverse kinds of deposits as the low-grade syngenetic manganese deposits in the Artillery Mountains of Arizona, the vanadium and phosphate [deposits] of Idaho and Wyoming, the Falconbridge nickel deposit, the Alaska-Juneau gold deposit. . . . The equation applies also to the porphyry copper deposits. . . ."

With the porphyry copper deposits as an example, the general pattern of this relationship has now been worked out to the point where it can be presented in more detail. There is nothing new or revolutionary either in the pattern itself or in the method of analyzing or expressing it. It represents nothing more than another frequency pattern, similar to those mentioned. What does appear to be new is the fact that more practical information than has heretofore been appreciated—including geologic conclusions—can be deduced from past records of mining operation.

The characteristics of each mineral deposit, of the kind being discussed here, can be expressed in terms of five curves, three of which are classical or standard frequency curves. One of these is what is known among statisticians and biologists as the "curve of diminishing increments"; the other two are the S-shaped or summation curve and its differential, the bell-shaped "curve of first differences," both described by Thompson.[5] The S-shaped curve is now 350 years old and "represents a certain common pattern among Nature's mechanisms. The growth of a child or of a nation, the history of a railway, or the speed between stations of a train; the spread of an epidemic, or the evolutionary survival of a favored type—all these things run their course . . . after the fashion of the S-shaped curve."[6]

The five curves mentioned are empirical curves discovered from available factual data.

As a conclusion from the analysis presented herein and from related studies, it may be stated as a general principle that in many mineral deposits in which there is a gradation from relatively rich to relatively lean material, the tonnage increases at a constant geometric rate as the grade decreases. Or, as the tonnage increases, the mineral content of the cumulative tonnage decreases at a constant declining rate.

I am not prepared to specify all the geologic types to which this principle may apply, nor even to claim it applies to every example of a particular type. Specific application can be determined only by trial. It fits the porphyry coppers, as described herein, and apparently also other deposits of similar type, in which small quantities of ore minerals are scattered through great volumes of shattered rock. It applies also to some kinds of bedded deposits, as illustrated by the Ar-

[1]Published by permission of the Director, U. S. Geological Survey.

[2]Chief, Mineral Resources Section, U. S. Geological Survey.

[3]Thompson, D'Arcy W., On Growth and Form, The Macmillan Co., p. 139, 1942.

[4]Lasky, S. G., Mineral Resource Appraisal by the U. S. Geological Survey, Colorado School of Mines Quarterly, p. 24, Vol. 45, No. 1A, January, 1950.

[5] Thompson, D'Arcy, op. cit., Chap. III, The Rate of Growth, pp. 78-285.

[6]Idem, p. 158.

tillery Mountains manganese deposit[7] and by the Idaho-Wyoming phosphate-vanadium deposits.[8] Calculations equating assay values against drill-hole footage for a well-known limestone replacement deposit suggest that the principle may have still wider geologic application.

Nor am I prepared to explain the geologic reasons why a mineral deposit should conform to normal frequency pattern beyond saying that a mineral deposit is a normal phenomenon of nature. The final distribution of copper in a porphyry deposit, for example, is the net resultant of several individual phenomena; the spacing and size of cracks in cubic miles of shattered rock; the nature, volume, concentration, and velocity of the solutions that brought in the copper; and the set of factors that caused precipitation of the copper. Each of these phenomena may be expected to adhere to an orderly scheme or pattern; it is therefore not surprising that their resultant also adheres to such a scheme.

This Mathematical Approach Offers Useful Information

The kind of study described herein has considerable practical significance. Some practical applications of the porphyry copper study itself (see Part II) are discussed briefly below, as examples designed to suggest to the reader the usefulness of similar studies with respect to the particular commodity, deposit, or problem that may concern him.

The most obvious practical implication is that it is possible, even ahead of actual exploration, to infer first, the tonnage and grade of material remaining to be found in a deposit, and second, the tonnage and range in grade of the material contributing the most metal. The validity of these conclusions patently depends upon the extent to which the curves can be extrapolated beyond the data. Operations on the porphyry copper deposits were begun on ore whose average grade was somewhat more than 2% of copper, whereas the present average grade is about 0.8 or 0.9%. Inasmuch as the curves fairly rigidly define the situation over that range of grade (about 1½%), it would seem reasonable, geologic evidence permitting and as an operating theory, to project them over an additional two- or three-tenths of a percent, which is the maximum possible extension remaining. Expressed another way, it seems practicable to project for 1 in. a curve already about 6 in. long.

A Typical Porphyry Deposit

A hypothetical average porphyry deposit has been calculated as part of the study. The characteristics of this "average" deposit can be said to be the expectable characteristics of any new porphyry copper that may be discovered. When a deposit actually is discovered and factual data are obtained, these characteristics can be modified accordingly to yield a new set of expectable features. As may be noted from Fig. 5, the ten deposits shown may be grouped roughly into three families —one family composed of H and I; a second family composed of E, G and J; and a third composed of A, B, C, D, and F. The expectable characteristics of a new discovery can be analyzed still further by calculating the average deposit for each of these three families and comparing any factual data with them.

These applications have manifest practical importance. For instance, study offers a basis for appraising the national copper position, inasmuch as the porphyry coppers contribute more than two-thirds of domestic copper production. Should the Michigan and Butte deposits also be amenable to this kind of study, the basis would be good indeed. The part played by the porphyry coppers, in such a national appraisal, can be determined by means of summing up the conclusions concerning individual deposits and by reference to the curve in Fig. 5 marked "U. S. total." This curve is the sum of the ore curves for the individual deposits and represents the known porphyry copper deposits as a group. From it can be read the total amount of ore (and therefore the total copper) present in the ground in known deposits for any specified average grade. Since we know the amount of past production, it would seem that we can deduce a good approximation of what remains. Taking into account irreducible technologic losses and costs, we can further deduce the copper remaining to be produced and the economic conditions necessary to achieve this copper production.

Part II—Nature of Data

The data used include, first, production records, and second, history of reserve estimates. It appears that the unit of study must be a geologic entity, as contrasted with the partial geologic entity represented at places by the operations of a single company. For example, Miami and Inspiration together constitute the geologic entity at Miami, and Kennecott and Consolidated Coppermines constitute the entity at Ely.

The well-managed mining company usually has to maintain a continuing estimate of its ore reserves, bringing estimates up to date once or twice a year. The estimate usually includes, first, only that material whose presence has been demonstrated with considerable assurance, and second, only material sufficiently rich to support profitable operation under the conditions of the time. Thus at any particular time the deposit is known to contain more mineral-bearing rock than is included in the estimate, this rock consisting of material still lower in grade than that accepted by the estimator and perhaps also of material of equal or better grade but not demonstrated to his satisfaction. The estimate is expressed in terms of the weighted average grade of all the material included.

With respect to the porphyry copper deposits, constantly improving efficiency in mining and processing has made it possible to mine each year, on the average, lower-grade material than was mined the year before. As a result, each year (again, on the average) the estimate of reserves is based on a lower cutoff than for the year before and has a lower average grade. Thus, over the years there is built up a record of increasing tonnage and decreasing grade. If the record is long enough, one should be able to read from it the relation between this tonnage and grade.

Traditionally, reserves estimates for porphyry copper deposits have been kept equal to 25 or 30 years' production. They are based on a tremendous amount of exploration data, particularly at those mines that have been in operation for many years. The record is, therefore, long and comprehensive. It is the record of a series of samples consisting of production to any date plus the material included in the reserve estimate of that date. The study described herein is based on the assumption that these samples are representative of the deposit; if they are, then it does not matter

[7] Lasky, S. G., Idem; Lasky, S. G., and Webber, B. N., Manganese Resources of the Artillery Mountains Region, Mohave County, Ariz., U. S. Geol. Survey Bull. 961, Figs. 3 and 4, 1949.

[8] By inference from personal communication from V. E. McKelvey.

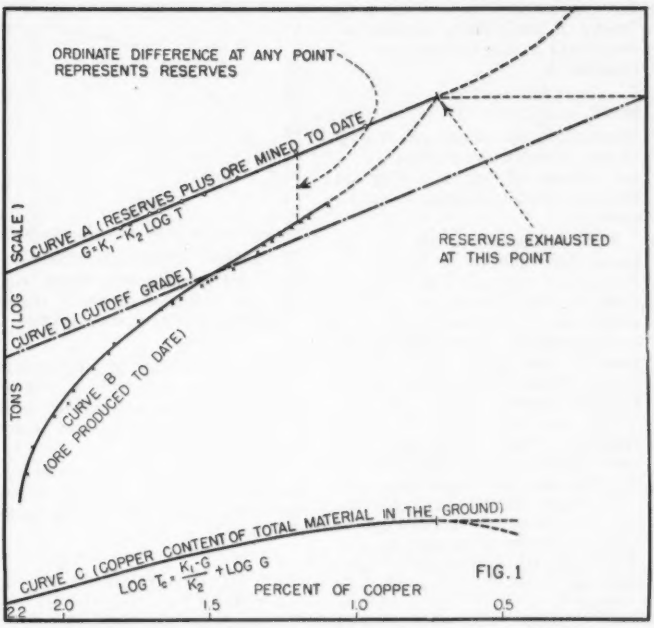

ORDINATE DIFFERENCE AT ANY POINT REPRESENTS RESERVES
CURVE A (RESERVES PLUS ORE MINED TO DATE)
G=K1-K2 LOG T
RESERVES EXHAUSTED AT THIS POINT
CURVE D (CUTOFF GRADE)
CURVE B (ORE PRODUCED TO DATE)
TONS (LOG SCALE)
CURVE C (COPPER CONTENT OF TOTAL MATERIAL IN THE GROUND)
LOG Tc = K1-G/K2 + LOG G
PERCENT OF COPPER
2.2
2.0
1.5
1.0
0.5

FIG. 1

RELATION BETWEEN GRADE AND TONNAGE of ore produced to date, total material in the ground, and contained copper for a typical porphyry copper deposit. Total material in ground in curve A includes reserves plus ore mined to date. Ordinate scale left off in order not to reveal identity of deposit.

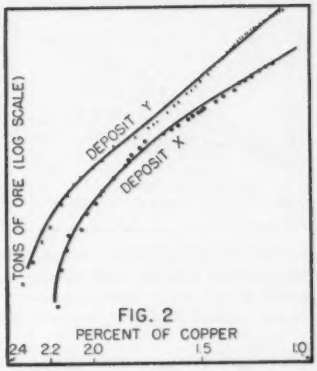


FIG. 2

RELATION BETWEEN GRADE and cumulative tonnage of ore mined. Ordinate scale left off in order not to reveal identity of deposit.

Table 1—Sample production record for a hypothetical porphyry copper deposit

(TABLE A, Production by years; TABLE B, Production in order of decreasing grade)

TABLE A			TABLE B			
Year	Tons (000)	Grade (% Cu)	Grade (%Cu)	Tons 000	Cumulative Tonnage (000)	Av. Grade
1912	1,400	2.12	2.16	2,900	2,900	2.16
1913	2,900	2.16	2.12	1,400	4,300	2.14
1914	3,600	1.83	1.83	3,600	7,900	2.00
1915	3,100	1.64	1.82	2,300	10,200	1.99
1916	4,300	1.63	1.76	1,800	12,000	1.92
1917	2,300	1.82	1.70	500	12,500	1.92
1918	1,800	1.76	1.64	3,100	16,100	1.86
1919	500	1.70	1.63	4,300	20,400	1.80
1920	1,900	1.55	1.59	3,200	23,600	1.78
1921	3,300	1.50	1.55	1,900	25,500	1.76
1922	3,200	1.59	1.50	3,300	28,800	1.73
1923	3,500	1.42	1.42	3,500	32,300	1.71
1924	4,000	1.08	1.14	3,600	35,900	1.65
1925	2,500	1.13	1.13	2,500	38,400	1.61
1926	3,600	1.14	1.12	3,000	41,400	1.58
1927	4,000	1.11	1.11	4,000	45,400	1.53
1928	3,000	1.12	1.08	4,000	49,400	1.49
1929	3,100	1.05	1.05	3,100	52,500	1.46
1930	1,700	1.01	1.01	3,300	55,800	1.43
1931	1,600	1.01				

Table 2—Relative Magnitude of Porphyry Copper Deposits

DEPOSIT	According to inferred total copper content STANDING	According to production to 1948 and reserves currently estimated STANDING
A	4	3
B	1	1
C	7	7
D	6	6
E	2	4
F	7	7
G	3	2
H	9	8
I	8	9
J	5	5

that the deposit may not have been drilled to its ultimate limits. The grade-tonnage "pattern" revealed by the samples is analogous to the shotgun pattern described in the opening paragraph, by means of which the number of holes that would be present in the outer circles of a large target can be calculated from the pattern of holes in the small target actually used.

When the material estimated as reserves at any particular time is added to and averaged with the ore produced to that time, the resulting figure can be said to approximate the total amount of material in the deposit at that average and corresponding cutoff grade. Inasmuch as ever lower-grade material is mined from year to year on the average and is included in succeeding reserve estimates, each succeeding "total" value shows a greater figure for tonnage and a lower figure for average grade. When the tonnage is plotted against the average grade, there results a curve that corresponds to equation:

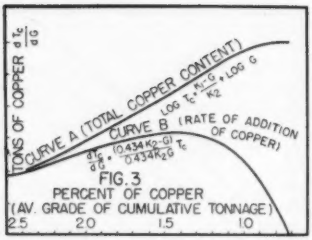
$$G = K_1 - K_2 \log T \ldots\ldots (1)$$

wherein T is the tonnage produced to any given time plus the estimated reserves, G is the weighted average grade of this tonnage, and K_1 and K_2 are constants to be determined for each deposit. K_2 is always preceded by a minus sign, inasmuch as T increases as G decreases.

Curve A, Fig. 1, is an example of a plot for an actual deposit. The plotted points are so tightly spaced that the curve does not have to be fitted to them but, on the contrary, is closely defined by them. According to this curve, the tonnage in this deposit increases at a compound rate of 14.9% for each 0.1% decrease in grade.

Production Records Show Tonnage-Grade Relationship

The grade of ore mined during any given period is adjusted by the operators to the economics of the time and thus reflects the influence of an independent non-geologic factor. The effect of this factor can be modified by statistically reassembling the annual production figures according to grade of ore produced. Table 1 illustrates this operation. Further, in order to be able to compare this record with that obtained from combining production figures with reserve estimates, the values of the declining grades are summed up into cumulative form, and the corresponding average grades are calculated, as in Table 1-B. When



RATE OF ADDITION of copper and total copper content with respect to grade of ore for a typical porphyry copper deposit. Ordinate scale omitted

the cumulative values are then plotted against the corresponding average grades, the resulting plot for porphyry copper deposits typically has the form shown in Fig. 2, in which plot X is for the same deposit as Fig. 1, and plot Y is for a second actual deposit. Plot X is duplicated as curve B in Fig. 1.

The left-hand part of this curve represents the years of operation during which higher grade parts of the deposit were selectively mined, and the right-hand part represents the years after bulk mining was established, rich and lean ore then being mined together. In the phraseology of palmistry, this curve is the typical "life-line" of a porphyry copper.

Curve A, Fig. 3, which represents the same deposit as Fig. 1, shows the form of the curve that is obtained when copper content is plotted against the grade of the ore that contains it. Curve A is replotted as curve C, Fig. 1. The equation of this curve is

$$\text{Log } T_c = \frac{K_1 - G}{K_2} \log G \ldots (2)$$

or

$$T_c = 10^{\frac{K_1 - G}{K_2}} G$$

Equation 2 has been derived algebraically from equation 1 by first changing equation 1 to read as follows:

$$G = K_1 - K_2 \log T + K_2 \log G - K_2 \log G \ldots\ldots\ldots\ldots (3)$$

and then developing equation 3 to the form of 2 by converting log T + log G to its equivalent, log T_c, where T_c is the copper content in tons.

For any particular deposit, the values of K_1 and K_2 are the same for both equation 1 and equation 2.

This is Thompson's S-shaped curve mentioned earlier.

If cumulative ore tonnage is plotted against the cumulative copper content, the resulting curve has the form shown in Fig. 4. This is the "curve of diminishing increments" mentioned in the introduction. Its equation is

$$y = a(1 - e^{-kx})$$

or $$T_c = a(1 - e^{-kT_0}) \ldots\ldots\ldots (4)$$

where T_0 is the cumulative tonnage of ore at any average grade, T_c is the tonnage of copper in this ore, and a is the total copper in the deposit.

The maximum shown by the curve for equation 2 (Curve A, Fig. 3, and curve C, Fig. 1) is the point at which copper ceases to be added; as this is a cumulative curve, at that point all copper-bearing material in the deposit has been included. From there on, only barren material could be added. In other words, the zero cutoff has been reached. Thus, practically, the curve should stop at that point, or continue as a horizontal line. The total copper content (and thus the limit of the copper curve) can be determined also by solving for a in equation 4; the differential of equation 4 is

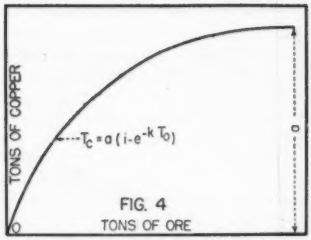
$$\frac{dy}{dx} = k(a - y) \ldots\ldots\ldots (5)$$

and a is the point at which the plot of this equation intersects the ordinate.

The point of zero cutoff determines also the practical limit of the curve for equation 1 (curve A, Fig. 1), for, practically speaking, the curve cannot extend beyond the point at which all the metal-bearing material is included. If barren material were averaged in, the curve would extend along the dotted path shown. It must be pointed out here that all rock contains a little copper, but as this hardly exceeds a few parts per million, zero cutoff can be considered synonymous with zero content.

The zero cutoff point indicates the extreme limit of the curve, but for some deposits the practical end of the curve is at some point to the left of the zero cutoff. Curve A and B, Fig. 1, converge, as logically they must. Since curve A represents reserves plus ore produced to date, and curve B represents only ore produced to date, the ordinate difference at any point represents reserves; when the deposit is mined out, the reserves are exhausted and the two curves end at a common point.

For some deposits these two curves intersect at a point to the left of that determined by the zero cutoff, and for those particular deposits the extreme limit of curve A



RELATION BETWEEN CUMULATIVE ore tonnage and copper content for a typical porphyry copper deposit. Ordinate scale omitted.

is taken at the point of intersection. This may or may not be a true mathematical point, but on the basis of present available data it seems to be a practical one.

Curve B, Fig. 3, is the form of the curve for the differential of equation 2. The differential equation is

$$\frac{dy}{dx}\left(\text{or } \frac{dT_c}{dG}\right) = \frac{(0.434\,K_2 - G)\,T_c}{0.434\,K_2 G} \ldots\ldots\ldots (6)$$

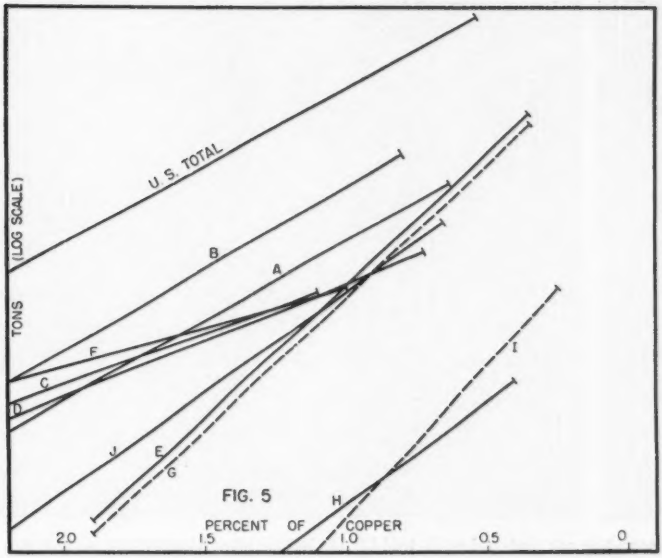
This curve is the "bell-shaped curve of first differences" mentioned in the introduction. It is one way of expressing the frequency of the various grades of ore, from rich to lean, that compose the deposit. For the deposit illustrated here, most copper is contributed by the particular material—100 million tons—that pulls the average grade down to the range 1.7 to 1.2%. By reference to the cutoff curve, explained below, it appears that this 100 million tons ranges in grade between 0.5 and 1.0% of copper.

Cutoff Grade

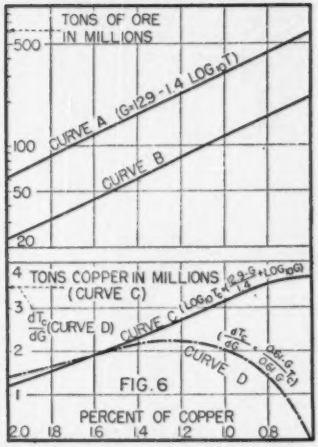
Consideration of cutoff grades leads to uncertain results. The cutoff grade used in calculating reserves is usually considered a "trade secret" by most mine operators. Little factual information is available, and what is available does not check with the mathematical analysis.

The relation between cutoff and average grade can be deduced mathematically by two methods:

One method depends on the fact that for every value for tonnage and corresponding average grade there is a corresponding cutoff grade, and on the fact that every tonnage value includes all material at and above the corresponding cutoff grade. Any additional material



GRADE-TONNAGE RELATIONS AND RELATIVE MAGNITUDE of ten American porphyry copper deposits. Groups A, B, C, D, F; J, E, G; and H, I are deposits with similar characteristics. Ordinate scale left off in order not to reveal identity of individual deposits.



CHARACTERISTICS of hypothetical average porphyry copper deposit. Curve A, total material in the ground plotted against average grade; Curve B, total material plotted against cut-off grade; Curve C, copper content; Curve D, rate of addition of copper.

(ΔT) would be below the existing cutoff grade, and the minimum grade of the additional material would then become the cutoff grade for the new total. If ΔT is taken as the tonnage corresponding to a particular grade bracket (ΔG), the lower value of this grade bracket is the cutoff grade applying to the entire deposit at the point of the corresponding ΔT. Both ΔT at any point and the average grade of ΔT can be calculated readily from equations 1 and 2.

As ΔT is made smaller and smaller, its average grade approaches the cutoff value; if it is made small enough, its grade may be accepted as equal to the cutoff. When the cutoff values so obtained are plotted against their corresponding tonnages, they define a curve of the same type as curve A, Fig. 1, and parallel to it.

The second method is equally short. The determination of zero cutoff point has already been described. This constitutes one point on the cutoff curve. A second point can be determined from the fact that for the highest-grade ore in the deposit the cutoff grade is the same as the average grade. This grade is roughly equal to K_1 of equation 1, as becomes evident by taking T at one ton. Connecting the two points gives the cutoff curve.

The curves obtained by the two methods are not precisely the same, one being parallel to the curve for average grade and the other diverging slightly from it; but for the range of values applicable to the deposits, the two methods give nearly identical results. Curve D, Fig. 1, is the cutoff curve, as thus determined, companion to curve A. The actual cutoff values used by the company engineers in estimating reserves during past years are higher than those indicated by the curve, but available data are insufficient to analyze the discrepancy. The reason for it may lie in the fact that the cutoff grade used by these engineers is not actually the grade of the leanest material included but is the average grade of the leanest minable block.

There is no necessary relation between curve D and B. Whereas curve D relates to the entire deposit as a geologic phenomenon, curve B relates to scattered grade blocks incompletely mined out; in effect, curve B represents only skeleton data.

Fig. 5 shows the grade-tonnage relations and relative magnitude of all the porphyry copper deposits of the United States except for a few of the smallest.

Table 2 compares the relative magnitude (on the basis of contained copper) as deduced from the mathematical analysis described in this paper, with the relative magnitude as would appear to be true on the basis of reserves plus production to date.

Fig. 6 shows the characteristics of the hypothetical average porphyry deposit calculated from the eight major deposits by the least-square solution. The equation for it is as follows:

$$G = 12.9 - 1.4 \log T \ldots\ldots (7)$$

The hypothetical average deposit contains a total of somewhat more than 600 million tons of ore averaging about 0.6% of copper, and in it the tonnage increases roughly at the rate of 18% for each unit decrease in grade of 0.1%. Most of the copper in it is contained in the 175 million tons having a copper content between 0.5 and 0.9%.

Of the many persons, mostly friends and geologists, with whom I have discussed the subject of this paper, I am especially and sincerely indebted to the following: R. M. Hernon, James Grunig, and W. W. Rubey of the U. S. Geological Survey; Julian W. Feiss of the U. S. Bureau of Mines; Walter A. Hendricks of the Department of Agriculture; Donald H. Menzel of Harvard College Observatory; and James P. Pollock. I am indebted above all to V. E. McKelvey of the Geological Survey, who called my attention to the logarithmic relationship on the Wyoming-Idaho phosphate-vanadium deposits.

IN THE SHORT-HOLE FIELD, some operators are finding an answer to their drilling problem in carbide-tipped steel, handled by a light rock drill set up with an air leg, or pusher, seen above. Photo by Canadian Copco, Ltd.

LONG HOLES IN ROCK after blasting the ring. Which is cheaper—to drill them with diamond drills, with coring or non-coring bits, or to drill them with rock drills, jointed rods, and detachable bits, with or without carbide tips?

What Is Best in Drilling Blast Holes? —It Appears to Depend upon Conditions

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THE LONGER an engineer is connected with the business of drilling holes for placing explosives to break rock, the more he must be impressed with the great variety of conditions with which he may have to deal. A few years ago, it was easy to select the best equipment for given conditions because the alternatives were few. Today, the variety of specialized equipment almost matches that of the conditions. This, with improved blasting techniques, has developed a healthy, progressive, experimental attitude on the part of operating personnel, and lower costs are being obtained in a field that was previously static.

Surface operations present the most variables in drilling conditions. Here one encounters problems related to the weather, the weathering of seamy rock, difficult topography, and overburden which may overshadow the basic nature of the rock itself. In this discussion, therefore, I will leave the complex surface field until last. After defining the term "drillability," I will examine general drilling practices, first in the short-hole field underground and then in the long-hole field underground. For this discussion, rock and ore will be considered synonymous.

What Is "Drillability"?

Results May Be Paradoxical. The ease with which a hole may be drilled in a given rock with any kind of equipment often bears surprisingly little relation to the physical properties of that rock as we attempt to define them. One kind of equipment may act in a seemingly paradoxical manner when compared with other kinds.

The best illustration of this is afforded in common percussion drilling in comparison with diamond drilling. Hard coarse-grained rocks, typified by granite, can be drilled rapidly and cheaply with percussion tools, but slowly and with high diamond loss when using rotary equipment. On the other hand, many of the fine-grained, tough, basic rocks, typified by basalt, are drilled much more slowly with percussion tools but are cut easily and cheaply with the diamond drill. Of course, when the rock is hard, fine-grained, and tough, as in rhyolites, cherts, or siliceous iron ore, both classes of equipment have a difficult time.

Drillability is therefore the reaction of particular equipment to a variety of combinations of physical properties. The rock may be hard, soft, or a combination of both. It may also be tough or friable, coarse or fine-grained, solid or fractured or jointed (fitchery), highly abrasive or sticky and muddy. Some exceptional examples are so contrary that they tend to swell and close the hole soon after it is drilled, as, for example, the serpentine at the Buffalo-Ankerite mine in the Porcupine gold field.

Conditions that affect drilling vary greatly. So does the specialized equipment that has been developed to meet them. Today's problem is to match the equipment to the task.

With Percussion Tools. Generally speaking, percussion tools do their best work in rocks that chip and fracture well under the blow from the bit regardless of the hardness of the rock. This action is usually amplified in the coarse-grained rocks and modified in the fine-grained ones, because the former tend to be friable and the latter tough. If a given rock does not chip well and seems to cushion the blow, it is said to be tough. Many so-called tough rocks, especially when they are not particularly siliceous, respond better to the grinding action of a diamond drill—at least in operation if not in cost.

Some broken-ground conditions do not seriously affect percussion drills but are very costly for diamond drills because of the rapid wear of the diamonds. Other badly jointed or "fitchery" conditions may cause common drill steel to become stuck regularly within a few feet of the collar of the hole, whereas diamond drills may not be affected because they are equipped with a shell behind the bit which serves to hold it on line like a bearing as it passes seams and joints. A given rock may act abrasively to one and not to the other, and some muddy ground may actually benefit one drill and hinder the other.

General Conclusion May Be Misleading. Any reader having an appreciation of what has been said will recognize the absurdity of drawing general conclusions based on test drilling in, say, "hard Vermont granite" or any other single formation for that matter. A designer of equipment would do well to choose the most difficult general type of rock his equipment is likely to encounter, consistent with uniformity and general recognition. Another conclusion is that, although percussion drills function well over a wide range and diamond drills cover a different and restricted field, conditions still occur where neither shine and new methods are likely to be developed to fill these gaps. For example, promising progress is being made with jet piercing and with roller gear bits, although neither of these is designed for underground use.

Percussion drilling has dominated the short-hole field since the days of hand steel and striking hammers. Until recently, however, rapid loss in bit gage limited the depth of hole it was practical to use. The introduction of tungsten-carbide-tipped steel has removed that limitation and, in conjunction with sectional steel, that drilling medium has been invading the specialized long-hole field with some success. However, the several physical conditions governing the long-hole field require an emphasis quite different from those governing the short-hole field. Each will be treated separately.

An Enormous Field

The Short-Hole Field Underground. The common practice in breaking rock underground is to distribute the explosives in a number of holes of the smallest practical diameter. Blast holes commonly drilled are 1¼ in. to 2½ in. in diameter and 6 ft. to 12 ft. deep. They are usually drilled by pneumatic percussion wet-type machines of tappet construction, striking hollow drill steel on which a four-point cross bit is forged or similar detachable bit is placed. Some exceptionally soft material is drilled with pneumatic rotary augers, but these will not be enlarged upon in this paper.

Anyone undertaking to drill with percussion machines in the enormous short-hole field must first make the following decisions as to the equipment he intends to use:

1. Heavy-bar or jumbo-mounted drills versus light hand-held jackhammers supported by an air-leg.
2. Alloy steels versus straight-carbon steel.
3. Forged steel bits versus detachable bits.
4. The use of tungsten-carbide tips in either of the bits mentioned under "3."

1. The Drills. For many years the tendency at metal mines has been toward the use of the big 3½-in. automatic-feed, long-shell, drifter drills for most work in drifts and stopes. These usually are of tappet construction and call for plain-end steel of 1-in. quarter-octagon section. They are mounted on heavy columns or bars and arms which, in spite of recent improvements, lack flexibility and take time to set up. Jumbos are a great convenience in drift work but have grown more and more elaborate and expensive as the years have passed.

The Air-Leg Set-up

In most European and South African mines, operators have departed radically from the above general approach by using light hand-held jackhammers. In recent years, by adding a supporting air-leg and turning to the use of tungsten-carbide-tipped, light-section steel, they have developed an excellent combination. A number of mines in Canada and the United States have been experimenting with it for some time and many are enthusiastic about the results. The changes involved, however, call for ⅞-in. hexagonal collared steel and chisel-type bits which makes other operators cautious. Nevertheless, a definite trend exists toward the light equipment at the present time.

2. The Steel. Alloy steels for underground wet drilling appear to have operational advantages when used with detachable bits or tungsten-carbide tips. However, straight-carbon steel as well as alloy steel will do a good job if the heat treatment is done under pyrometer control in the common oil furnace or in a salt bath.

3. The Steel Bits. The trend away from the common four-point bit forged on the steel has been continuous. Today the single-pass four-point detachable bit appears to rule the steel-bit field. Intense competition between half a dozen different manufacturers of detachable bits has brought about a great many changes in details of design affecting drilling ability and means of connection, so that one may expect twice the footage from his single-pass bits today that the best would give him five years ago. The chief improvement has been in connections—not only in the socket or thread design but also in better control of shank preparation and heat treatment. Practically all the connections outlive the steel bit and the frequency and ease of the reconditioning of shanks is now the

governing feature where the cutting ability is the same.

4. Tungsten-Carbide Inserts. The present fields for tungsten-carbide tips are where steel bits do poorly in hard, tough, or abrasive ground and also for drilling deeper holes without serious gage loss. This latter ability opens up important undeveloped possibilities in the little known intermediate depth range of from 15 ft. to 35 ft., and in some cases permits percussion drills to compete favorably with diamond drills in the long-hole sublevel stoping field. This will be discussed later.

The consensus seems to be that tungsten-carbide tips have done a remarkably good job but are more expensive than they should be. At present, in good drilling ground where the average steel bit can be expected to run 4 ft. or more, carbide tips have rarely replaced the latter type because they are expected to average 400 ft. each to break even on bit cost. Usually some failure occurs before this footage is reached—not in the wear or destruction of the tungsten-carbide inserts, but in the insert bonding, the connection between detachable bit and steel, or breakage of the steel itself. These may be only growing pains leading to big cost savings in the future, but they are preventing the tungsten carbide from delivering its full effective value now. To attain a balanced combination means correction of these faults or devising a cheaper, rougher manufacturing job.

Of course, the demand that the bits must compete on direct cost per foot only is unfair to tungsten carbide. Invariably the penetration speed is increased up to 50% by its use and fewer steel changes are necessary. Both of these results give a lower labor cost per foot that may well outweigh small adverse differences in bit cost.

A Practical Answer

Help From Light Equipment. One practical answer to the difficulties enumerated is the adoption of the light drilling equipment mentioned under (1). Holes of smaller diameter are drilled with light machines, light steel, and a chisel bit containing only one tungsten-carbide insert. Less work (less compressed air) is required to make the smaller hole; light blows do not unduly stress the steel or the insert; elimination of the connection between bit and steel removes a source of failure that has been rather troublesome in the smaller diameters; and the single insert is comparatively cheap and may be brazed in right on the job. But this combination, and particularly the chisel bit, cannot be universally applied and other solutions must also be sought.

The Bit Attachment

Connection Problem Harder. From the manufacturer's point of view, for convenience in general handling and for universal application, the four-point detachable carbide bit is likely to be with us a long time. This, however, means that the life objective for a connection is now 100 times the objective that plagued the industry during the development of steel detachable bits! When one recalls the experimentation of that day with threads and slots and sockets, he must appreciate that present connections have already been vastly improved and that ultimate success in this field can be expected even though the matter of the connection be a retarding factor now.

Cheaper Bits Eventually. The industry is going through an expensive, experimental, introductory period. Once some degree of standardization is reached and volume mounts, the unit cost should come down. Some operators believe they can buy their own inserts and make up their own bits much more cheaply, and some will probably try. A quarry operator at the February, 1949, meeting of the National Crushed Stone Association stated that when his purchased tungsten-carbide bits lose gage or the inserts become loosened, he takes the inserts out, turns them end for end, and rebrazes them in the bit successfully.

The present tungsten-carbide detachable bit is priced about the same as an EX diamond-drill bit after salvage credit, and therefore should be kept track of just as carefully. Otherwise many will be subject to loss through careless handling by crews who are accustomed to bits worth only a few cents which they throw away more or less when they feel like it. Systematized collecting, checking, and resharpening is imperative if full value is to be gained. Inserts stay in better and last longer if they are not permitted to get too dull.

The Long-Hole Field Underground. Diamond drills have held the long-hole sub-level stoping field almost exclusively since the method was perfected at the Noranda mine about 12 years ago. Before and during the war, the existence of a good supply of small cheap diamonds, plus the exceptionally efficient use of holes and explosives inherent in this method of breaking ground, extended its use to hard siliceous ores as well as to the large sulphide orebodies, the magnesites and the limestones. Since the war, the price of diamonds has more than doubled and has made the diamond-drilling of siliceous ores much more expensive. Some of these ores chip well with percussion equipment and, where steel bits were concerned, only excessive gage loss of the bit prevented its use. As soon as tungsten-carbide tips were introduced, they were tried at some of the mines where diamond-drilling costs had become prohibitive.

Changeover at Holden Mine. Perhaps the most successful changeover was at the Howe Sound Co.'s Holden mine where rings of holes, laid out for diamond drills with holes 60 ft. deep, were successfully drilled with tungsten-carbide bits and sectional steel. Few other mines have equalled the results at Holden—not through any inability on the part of the tungsten-carbide bit but because of operational difficulties encountered in deep holes. Diamond drills have the advantage in deep holes, that there is no loss of mechanical efficiency with depth, that smoother, straighter hole is drilled, that rod grease tends to support minor caving sections, and that binding or breaking in the hole is absent with its time-consuming fishing problems. Some of these may become prohibitive with percussion drilling. With the latter, a long rough hole, no matter how cheap to drill, may be difficult and even dangerous to load, and it may be impossible to prevent gaps in the column of explosive, this in turn causing partially-missed holes.

Some New Conditions

Problem With Jointed Rods. The drilling of long holes with percussion drills adds a number of new conditions to the ones discussed under short-hole drilling and modifies some of the others. Connection problems are magnified in proportion to the number of pieces of sectional steel that must be coupled together to reach the depth desired. In view of the serious limitations

in strength presented by sections of small diameter, it is not surprising that the trend has been to larger holes and heavier sections where the couplings and the steel stand up reasonably well. The Holden mine has been leading the way in this direction and now uses holes 2 in. in diameter, with 1⅛-in. hollow-round steel and heavy, sleeve-type, threaded, alloy-steel couplings in which the ends of the sections butt together.

Of course, the longer and heavier the piece of steel and the larger the number of couplings between the striking piston and the cutting edge of the bit, the more power will be absorbed in the steel itself and in friction between it and the wall of the hole. The need for extra power in contingencies, such as when the steel binds or sticks, has led to the adoption of heavy-duty 4-in. drifters and lugged steel, together with higher water pressures and specially designed water swivels ahead of the chuck.

Carbide Can Take It

Withstands Heavy Abuse. This furnishes a big contrast to the trend to very light equipment for short-hole work, and many question the use of heavy-hitting drills with tungsten carbide. If they could see the remarkable manner in which tungsten carbide withstands very heavy abuse with the larger, surface, wagon drills drilling dry, they would be satisfied that tungsten carbide can "take it." Likewise, the breaking conditions in large sublevel stopes permit using holes of larger diameter with correspondingly larger burdens that are easier to load and less likely to wander off line.

On Surface Bigger Holes

Conditions Are Different. Discussion so far has been restricted to holes of small diameter as used underground to give good distribution of powder for "tight" work or good fragmentation. In some glaciated districts where outcrops of clean solid rock are prominent, the same class of work can be done on surface. Generally speaking, however, surface work with small holes is characterized by "grief" in the form of weathered joints, sand seams, variable ground, difficult setups, overburden and the weather itself. The general tendency is to reduce the troubles as much as possible by using larger and fewer holes and heavy rugged equipment. Heavier charges of explosives may be used. These give effective fragmentation, now that short-period delays are being used.

Water Would Help

Most Surface Drilling Dry. Another radical difference in surface work is the common objection to the use of water. Most drilling is done dry. Certainly, water adds to the difficulty of winter operation. Most crushing and screening plants prefer dry rock and it may also be inconvenient to maintain a water supply. Nevertheless the tendency seems to be overdone and, as far as drilling in hard rock is concerned, the use of water to keep the bit cool and support the shank could greatly improve bit life, shank life and footage per shift.

For small-hole drilling, jackhammers and wagon drills are used extensively, the choice depending on the size of the job, depth of hole, and the surface contour. Shanked steel, either collared or lugged, is almost always used in order to combat bad ground by raising and lowering the steel with the machine running. Shanked steel calls for ordinary hammer-drill construction, as opposed to the anvil-block type so popular underground.

A wagon drill is a highly productive unit when used on level benches about 20 ft. deep. It consists of a 4-in. heavy drifter-type drill with a long chain feed and portable, pneumatic-tired, adjustable frame. It is generally used with 1¼-in., hollow-round, high-carbon drill steel. Forged or detachable bits may or may not contain carbide inserts.

Diamond drills are occasionally used to operate high benches where the ground is too rough for heavy equipment or the rock is particularly favorable to diamond drills. Multiple benches can be avoided and high faces can be carried at a slope of 60 or 70 deg. for safety and to give the bottom a better chance to break.

Bigger Drills

Churn Drills Hold Their Ground. Most of the larger quarries and open pits throughout the country use 6-in., 9-in., or 12-in. holes which are 40 ft. to over 100 ft. deep and which are put down by churn drills. No radical change has taken place in these drills for a great many years, although they have been improved mechanically and the units have been made larger. They drill big holes in most formations cheaply but are slowed down by dense siliceous material and other tough rock where the bit life is so short that resharpening becomes a major item of expense. So far, tungsten carbide has not been successful in bettering this condition.

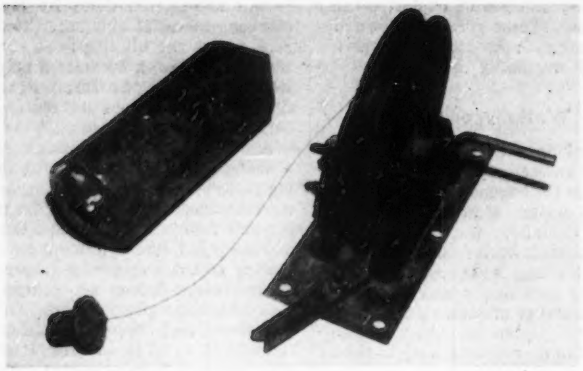
A manufacturer has brought out a self-powered and self-propelled big piston drill which under certain circumstances can compete in the big-hole field. Actually it is a large marine-type tower drill mounted on tractor treads and powered by one or two diesel-driven air compressors which are also mounted. First cost seems high, but for 6-in. holes from 25 ft. to 50 ft. in depth it can often produce footage equivalent to four churn drills. Using four-point cross bits set with big inserts of tungsten carbide, this drill is seldom idle for changing the bit, as the tungsten carbide stands up very well under the severe dry pounding. It is a highly productive, easily-moved piece of equipment and, where working face is limited when production demands are high, it has no equal today.

A Rotary Rig. Another drill manufacturer has adapted a large rotary rig to use the type of roller gear bits common in oil fields. It is limited to formations softer than dolomite and the cuttings may be removed by a good flow of circulating water or a strong blast of compressed air. There is no depth limitation and it drills a smooth, straight 6-in. hole much faster than a churn drill, particularly in variable ground where a churn drill is inclined to wander and get stuck. The teeth of these roller bits may contain tungsten-carbide tips.

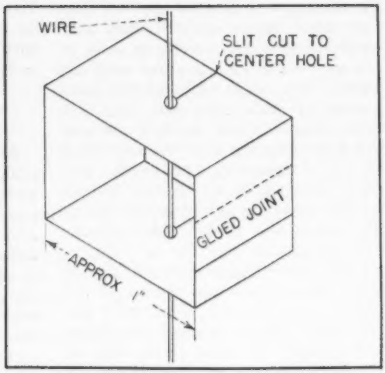
Finally there is jet-piercing, a development which is designed to make large holes at a rapid rate in hard taconite and trap. So far it has been limited in depth to 30 ft. and in hole diameter to 4 to 9 in. A hand-held blowpipe for block-holing also seems to have considerable promise. The chief supply items are oxygen and fuel oil, but very little is known as yet about its full-scale operating economics.

Conclusion

It will be seen that the subject of drilling rock for blasting has been covered only in general terms. The scope is enormous, variety infinite, and paradoxes frequent. As in so many other fields, one must keep an open mind and define his terms if he is to be understood or is to understand the problems of others.



1. PLUMB BOB AND REEL used in survey can be made in any mine shop. Steel plumb bob weighs about 75 lb. Wire is .037-in. piano wire.



2. PAPER BOX, allowed to slide from top of shaft, indicates if wire is free of projections.

Shaft Surveying Method Features

R. R. DURK
Assistant Mine Superintendent

E. S. McINTYRE
Mine Engineer
Combined Metals Reduction Co.
Pioche, Nevada

ACCURATELY TRANSFERRING the meridian from one level to another through shaft or raises is a common problem for the mine surveyor. Here is a technique that has reaped consistently fine results at the Caselton mine of Combined Metals Reduction Co., Pioche, Nevada. For example, the engineering department there recently completed a connection survey between two drifts on the 1,200 level with an error of closure of 1/9600 and an angular error of closure of 30 sec. The survey involved transferring the meridian from a triangulation system on the surface to the 1,200 to 1,400 levels; from the 1,400 level to the 1,200 level at the opposite end of the workings through a 300-ft. vertical raise. They carried the survey through 7,480 ft. of drifts.

The work requires some special equipment that can be easily manufactured in most mine machine shops. Accompanying photographs showing this equipment were taken by H. Poller, assistant engineer. Plumb bobs and reels used at Pioche are of our own design (Fig. 1). The steel plumb bob weighs about 75 lb. and is supported by 0.037-in. steel piano wire wound on a reel. They are equipped with a screw cap for attaching the wire.

The reels are compact, with a base that can be secured to an ordinary 2x12-in. lagging, and designed to hold sufficient wire for the longest planned plumbing. Spool section of the reel is drilled so that a pin can be inserted to provide a locking device. A notched guide for the wire is attached to the base with a bolt to allow horizontal movement for minor wire adjustment. For deep shafts or long raises the motion of the plumb bobs is dampened in barrels or cans of water.

Type of transit to be used depends on the accuracy required. In our case two conventional mine transits are used, one reading directly to the nearest 1 ft. (used on top setup), and one reading to the nearest 30 in. (used on bottom setup). If only one transit is available, the survey can be successfully completed providing the top and bottom of the raise or shaft are accessible without disturbing the wires. For horizontal and vertical measurements, steel tapes reading to hundredths of a foot are employed.

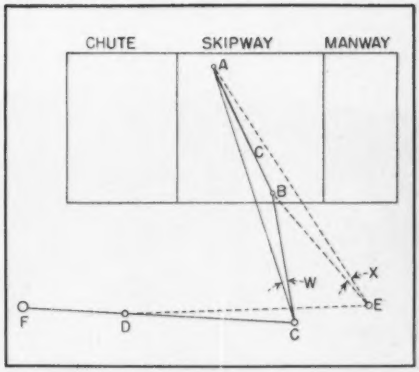
The best method for vertical shafts and raises was found to be the Weisbach method of triangulation using a small angle, 2 ft. to 15 ft., between the instrument and the two wires.

It is best for the engineer to plan a plumbing operation when no other work is to be carried on in the vicinity. Since the actual instrument work is time consuming, operations can be greatly facilitated by studying the problem a day or so ahead of actual surveying, and transporting the necessary equipment to the scene. A few pieces of lagging, nails, axes, etc., are generally required, and much time can be saved by having the right lengths of timber on hand.

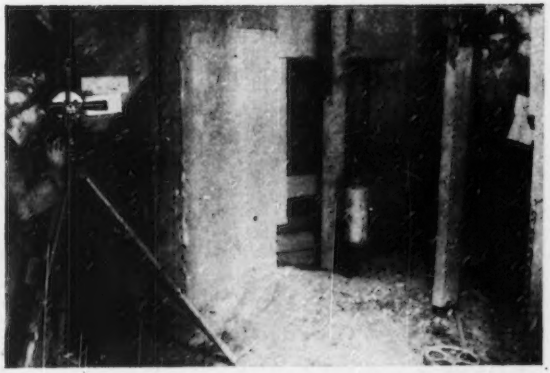
Plumb Bobs

Hanging plumb bobs usually requires considerable juggling of the reels to find the best possible position of the two wires in the shaft so that a favorable angle may be obtained between the wires and instrument on both top and bottom. This is especially true in small raises where both wires generally have to be hung in one compartment. Place the wires at the maximum possible distance apart since a longer base line improves the accuracy of triangulation. On jobs involving deep shafts or raises and where the crews on top and bottom cannot communicate by voice, signals must be used. These can be worked out by employing lights, regular hoisting signals installed in the raise or shaft, or by combination of both.

With the reels placed in a temporary position, the wires are lowered and the position adjusted to meet the above requirements. The reels then are firmly secured in position. Plumb bobs hung on the wires are adjusted until they hang freely at the proper height. If it is necessary to dampen the swinging



3. ANGLES from stations C and E to plumb bob wires A, B must be carefully measured.



4. ENGINEER sights on swinging plumb bob wires from station C at bottom of raise. Station E is only about one inch away.

Accuracy

motion of the plumb bobs, they should be placed in the water at this time.

After the plumb bobs are hung, it is imperative to see that the wires are free for their entire length. To eliminate having to climb the shaft, we worked out a unique solution to the problem. Several small boxes are made of light paper (Fig. 2), placed on the wires at the top and allowed to slide down. As any projecting nail, splinter, or other material will cause them to hang up the wires, the wires are assumed to be free if the boxes reach the bottom.

While the plumb bobs are being dampened, the transit is set up and station C is established (Fig. 3). Station C should be situated in such a position that angle W equals 2 to 15 min. and distance BC equals AB, the distance between wires, as nearly as possible. In small raises this condition cannot always be met as the focal distance of the transit may be somewhat greater than the maximum distance obtainable between the wires. It has not proved troublesome in practice and will not except on jobs requiring greater accuracy than the average plumbing survey.

Station C is established by plumbing over the transit. It is not necessary to set point C exactly over the center point of the transit during the first trial, but after a close approximation is obtained, the final adjustment is made by means of the transit head motion. This step is very important and should be done as accurately as possible.

As soon as the transit has been set up and the wires have quieted down to their normal swing, the actual turning of the angles is undertaken. At this point we have departed from standard practice. No attempt is made to find the mean swing of the wires on a scale and clamp them in position. Instead sights are taken on the swinging wires.

Employing the angle right method, angles W, BCD, and DCA are measured by repetition.

To eliminate the effect of swing and width of the wires, first turn the angle between the left side of wire A at the point of extreme left swing to the right side of wire B at the point of extreme right swing, which gives the maximum angle. Second, turn the angle between the right side of wire A at the point of extreme right swing to the left side of wire B at the point of extreme left swing, which gives the minimum angle. Continue this procedure until the six turns have been made.

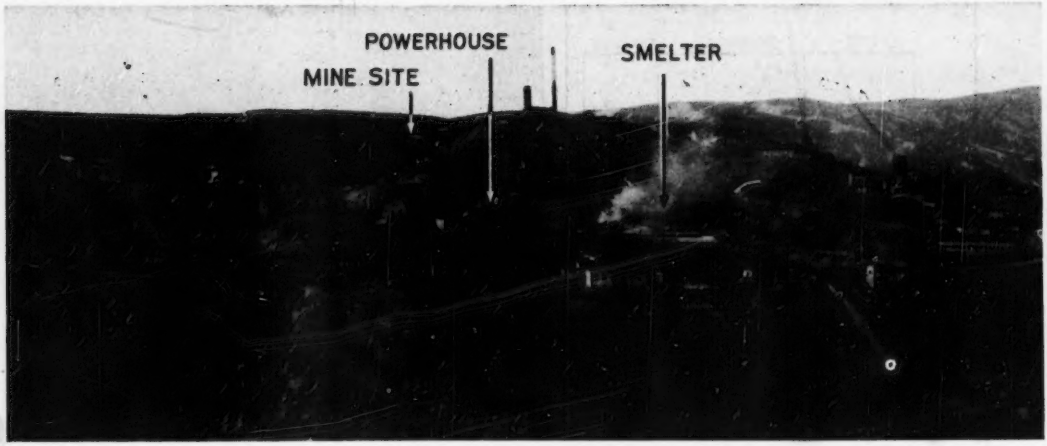
Determining Angles

In turning angles BCD and DCA, the same procedure is followed except that in sighting the plumb bob hanging from station D, the swing is small and can be dissected as practices in conventional mine surveying. After the above angles have been measured and the mean angles determined, their sum should equal 360 deg. + 10 in., or the process repeated until this condition is met.

Four measurements are made from this setup—distances AB, BC, AC and AD. Distances AB, BC and AC should be measured to the nearest thousandth of a foot to make sure that they are accurate to the nearest hundredth. Horizontal distances are taped whenever possible. When angle W is small, the distance AC will equal the sum of distances AB and BC within the limits of measurement. A level line is sighted along the wires by means of the transit, barely to one side so that the tape does not touch the wires, and a spad driven on line in the timber on the far side of the raise. By hooking the zero end of the tape to the spad, one man can easily hold the tape steady while his partner makes the readings. A reading is taken at each wire and at the center of the transit, after which the distances are calculated and recorded.

When two parties are working simultaneously at the top and bottom of a raise or shaft, neither should start measurements while the other is turning angles because accidental touching of the wires will increase their swing and result in possible error.

When the necessary angles have been turned and the measurements completed, the transit is moved to a similar position on the other side of the wires. Station E is located, and the entire process repeated. This is in effect an independent survey and after calculation in the office, should check the first. Distance between stations C and E on the diagram is greatly exaggerated for clarity. Actual distance in the field will be about 1 in., depending on the size of the angles between the wires. When the second set of angles and measurements are completed, the transit is moved to station D, and angles CDF and EDF measured.



ERGANI MINE AND SMELTER in eastern Turkey produce about 10,000 tons of blister copper a year, virtually the

Ergani, Mainstay of Turkey's

S. E. BIRGI
Director, Turkish State Copper Mines
Ankara, Turkey

ABOUT 10,000 METRIC TONS of blister copper are produced annually at the Ergani mine and smelter near Maden in eastern Turkey. Although other copper properties are under development, Ergani's production has virtually been Turkey's production since the completion of the smelter at Ergani in 1939. Here, where man probably did his first smelting, engineers have blocked out reserves comprising 2,250,000 metric tons of pyritic ore averaging 9.07% copper for direct smelting, and another million tons running 4 to 5% which will have to be floated.

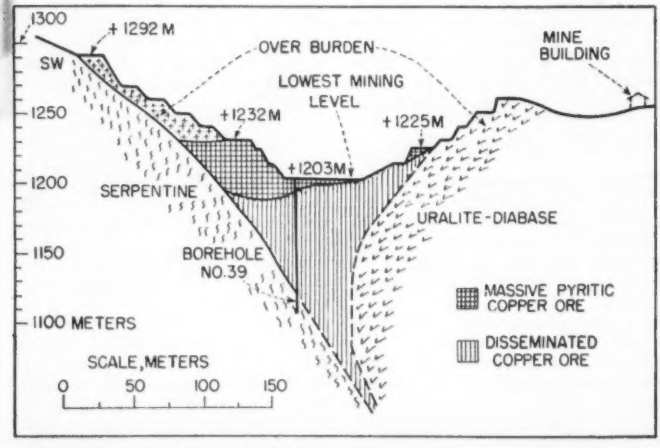
The orogenic system of the Eastern Taurus Mountains in the region of the Ergani deposit, is composed principally of basic igneous rocks, schists, marly and calcareous shales and limestone. Rocks of igneous origin are ophiolitic in character. They are serpentine, gabbro, diabase and surface flows of diabasic magma. The latter is interstratified with the schists of the lower Eocene, forming a Flysch series.

Serpentine, the oldest rock in the system (probably Mezozoic), has regional distribution in this part of the country. In the same serpentine formation, 12 mi. to the north, lie the famous chrome ore deposits of Guleman.

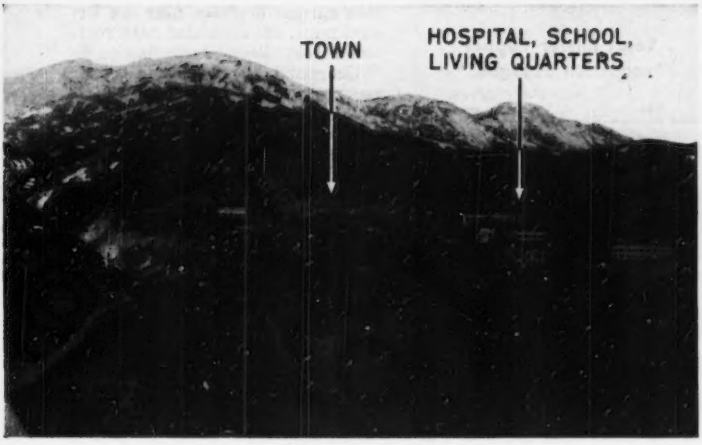
The diabase is believed to be younger than the gabro and sometimes forms dikes and veinlike bodies in the latter. There are also transitions of one rock into the other. Augite in the diabase is altered to uralite, so that usually we have an uralite diabase.

This uralite diabase plays an important role in the formation of the orebody. The chlorite rock (chloritfels) which is found at the contact of the orebody is believed to be a chloritized and mineralized diabase. Sulphide minerals forming the orebody are the result of impregnation and replacement in the chlorite rock. It is believed that mineralizing solutions (and to small extent, the gases) were the last manifestation of one and the same magmatic movement.

The various sediments, especially their most important mem-



OREBODY is roughly elliptical in horizontal section. The long axis extends about 1,150 ft. in NW-SE direction. The short axis is about 530 ft.



entire output of the nation. Reserves are estimated at 3½ million tons.

Copper Mining

ber, the schists, were originally in the form of a continuous cover over the igneous rocks. Today we find them as remnants of erosion in isolated patches.

In rare instances, the schists are thoroughly silicified. Such material was used as a flux for smelting in early times. We have used them experimentally in the blast furnaces but results were not very encouraging. Yet, mixed with purer flux they might be used in emergency.

The tectonic picture for the area around the Ergani mine is typical of the regional movements in this part of the Eastern Taurus chain. There were three phases to these disturbances.

First group of movements caused the general release of ophiolitic magmas. The age is unknown, but it is certainly pre-Senon.

The second group of movements was due to compression forces from the Northeast, forming a series of thrusts. These resulted in a regionally important imbricate structure, a characteristic feature of local geology. In the author's opinion, the Ergani orebody is related to such a thrust movement.

Third group of movements is a series of gravity faults of more recent date. Formation of the Dicle Valley (Tigris River), flowing through this area, is believed to have been originally started by these post-Eocene forces.

Although we would not like to generalize on the matter, we have the impression that the third phase of tectonic activities seems to have caused an intense fracturing of the formations but that the faults did not possess an important throw. Probably these faults have been responsible for the permeability of the ore. The steplike flexure that the northwestern part of the orebody forms, may also have been due to these forces.

The orebody in horizontal section is roughly elliptical in shape through the massive pyritic part. Its long axis is about 1,150 ft. with a NW-SE direction. The short axis is about 530 ft. It has, or rather it used to have, a sharply defined, flat top, slightly tilted to the south. The orebody is encased between serpentine to the south and chlorite rock or diabase to the north. There is no doubt now that the surface of the serpentine contact has been formed by a tectonic movement. The serpentine contact at the central part of the orebody dips with about 40-50 deg. to the NE, and is practically free of mineralization. The diabase or the chlorite rock, on the other hand, is intensively mineralized.

Under the typically massive pyritic part of the ore formation, the ore consists of streaks, accumulations and impregnations of pyrite and chalcopyrite in chlorite rock in the first place, and chalcocite, covellite, a little sphalerite and other sulphides accessorily. A certain amount of magnetite is also found, and its association with minerals such as spinell, ilvait, chlorite, actinolite, prehnite, epidote, and rutile led to the view that the first phase of the mineralization was pneumatolytic. Although most of the magnetite seems to have been replaced by the ore minerals of the later hydrothermal phase, its presence is still important. Analysis of eight cores from different borings averaged 8.2% magnetite. This type of ore has not yet been mined but some of it is so rich that it can be treated directly in the blast furnace like the massive pyritic ore. Because of the magnetite content difficulty might be experienced in the smelting of such an ore if used by itself. Therefore, it might be safer to mix such an ore with pyritic ore before smelting, which procedure implies that the whole program of mining should be organized accordingly.

In the horizontal plane, the mineralization decreases more rapidly in the transversal direction to the long axis, than it does in the direction of the long axis, in the SE direction.

As already mentioned, the orebody in its upper part is massive in character and contains the greater part of the copper reserves. It is principally composed of pyrite, chalcopyrite, covellite and a little chalcocite.

A typical analysis of the pyritic ore follows:

Cu	10.02%
Fe	39.47
S	48.39
SiO_2	0.71
Al_2O_3	0.53
As	0.12
MgO	0.60
CaO	0.19
Co	0.52
Ni	0.07
Se	—
Au (grams per ton)	1.4
Ag (grams per ton)	21.9

About 9% of the copper content of the ore is in form of soluble copper sulphate; this has been formed with the active help of the iron sulphate solutions. Some of these copper salts are being constantly leached out of the ore by underground waters. To give an idea of the importance of this, let us mention that 700 metric tons of cement copper with 70-75% Cu are being obtained yearly by treating the mine waters over scrap iron.

A trace of nickel from the nick-

eliferrous pyrrhotite, which occurs accessorily, and an average content of 0.4% cobalt in the massive ore should also be mentioned.

The change from the massive pyritic into a disseminated ore in depth is rather sudden and the boundary is sharp. But the downward extension of the central part of the orebody, although strictly speaking no more massive in character, is still so high in sulphides, that owing to its high sulphur content of about 30% S, some of it with a high copper content will be directly smelted in the blast furnaces. Although the mineralization continues to an unknown depth, boreholes have shown that generally at 45 to 60 meters depth from the 1,203-m. level down (the elevation of the lower limit of the massive section of the orebody is at the 1,195-m. level), copper values fall to less than 1% Cu, and in one case this limit reaches down to –82 m.

Present reserves are as follows as of Jan. 1, 1949:

	Metric tons
Massive pyritic ore, or ore rich enough to be directly treated in the blast furnaces (average grade 9.07% Cu)	2,250,000
Disseminated ore, to be treated in a new flotation plant (average grade 4.0% Cu)	970,000
Fine ore stocked, to be treated in the flotation plant (average grade 5.0% Cu)	315,000
Total	3,535,000

These figures show that the massive pyritic ore is exceptionally high grade. Although the mean value is 9.07% Cu, rich sections containing up to 15% Cu are not unusual.

Ore Genesis

Although in studying the orebody no one of our observations is conclusive, taken by itself, collectively, they are very suggestive. In the author's opinion, the whole system of diabase and schists north of the orebody, probably forms a slice or "scale" which was thrust over the serpentine. The plane of the thrust fault furnished the necessary avenues to hypogene solutions.

The serpentine under the thrusted slice, dips with about 40-50 deg. to the NE. This is also the regional direction of the thrust faulting movement. With gravity faults, steeper dips of the fault plane are prevalent. With thrust faults, on the other hand, a moderate dip such as this one is more common.

Total Blister Copper Production at Ergani*

Year	Metric tons
1939	4,233
1940	6,833
1941	9,010
1942	7,400
1943	9,235
1944	10,050
1945	9,544
1946	10,050
1947	10,080
1948	10,979
TOTAL	87,414

*Production of blister copper began in 1939.

The great variety of rock outcrops (mostly brecciated material) lying along the serpentine contact from a rather irregular belt. These brecciae have only been observed at or near the surface. At a little distance from the serpentine outcrop and roughly parallel to its limit line, runs a succession of small gravity faults, mostly through this agglomerate or brecciated material. It formerly was believed that this broken line formed one single big fault and actually the fault from which the mineralizing solutions ascended. The total length of this line of faults seems to be only 1,050 meters (3,200 ft.); and although the ground is devoid of vegetation or of any appreciable cover of earth, a northwesternly extension to this fault line could not be detected. Also no sign of such a fault can be found on the blank rock walls of the stream of Mihrab Dere. The latter certainly ought to have crossed the extension of such a fault, had the fault been of any great importance. Extension of this fault in depth seems to be quite irregular. A fault of great importance would not change its direction and dip on such a short run and then disappear.

Thrust Faults Prevail

If we consider these facts in the light of a thrust faulting movement, we come to the conclusion that the agglomerate of torn and brecciated formation is probably nothing but the accumulated detritus in front of the advancing thrust slice. The crescent-like line formed by the faults, seems to have been caused by a settling action of this detritus, probably during the third phase of the tectonic movements. Direction toward which the lines converge, is suggestive.

We have mentioned that the Gulemman chrome deposits, near the Ergani mine, are connected with rootless thrust slices. According to de Wijkerslooth the two small copper occurrences 1 and 2 kilometers distant and to the NW and N respectively of the Ergani Mine are also connected with a similar thrust faulting. These facts should be borne in mind, to obtain a complete picture of the genesis of the deposit.

Argillaceous red schists, on top of the diabase or chlorite rock, form a more or less impermeable blanket over the channel. This facilitated the horizontal diffusion of the mineralizing agents into the brecciated material, in the plane of the thrust fault and into the adjacent diabase. Accumulation of massive pyrite and of chalcopyrite in the upper part of the orebody, and the flat, even top surface of the latter suggest the limiting action of the impervious roof.

Lack of an extensive gossan formation can be explained by this blanketing action. Red material with which the orebody was originally covered and which has been partly stripped in recent years, has been determined as altered red schists, with some hydrous iron oxide content. Except for the brownish red color, this material lacks the other characteristics of real gossan.

Mineralization

From the practical point of view of future mine development a clear understanding of conditions under which the ore was formed is necessary; especially for determining the possible extension of the mineralization. Observations and deductions stated above, seem to us the most probable genesis of the deposit. Accordingly the most likely place to encounter a new mineralization of economic importance would be along the contact plane of the serpentine with the chlorite rock, and preferably right under the red schists.

An important microscopical study by Dr. M. A. Sirel reveals that some of the pyrite in the upper part of the deposit has been formed by the action of sulphur bacteriae. This implies a submarine formation. He stated recently that the theory of the ascending mineral solution on the plane of a thrust fault, is quite compatible with a deposition of pyrite by bacterial action, the discharge of the hypogene solutions taking place at the bottom of the sea.

Secondary Enrichment

F. Behrend explains the formation of the massive pyritic main (top) part of the orebody by supergene enrichment activities, on a grand scale. Romieux, but especially de Wijkerslooth goes to the other extreme, denies the existence of a well defined zone of enrichment, and minimizes the importance of such a downward transport of the copper. We shall base our observations strictly on the last 10 years of open-pit mining.

Benches between the 1,203 and 1,215-meter levels are generally regarded as rich ore, and the two benches above the 1,215-m. level and reaching into the 1,230-m. level (which elevation is about the top of the orebody) are poorer. The production, therefore, has to be carefully balanced between poor and rich ore, to provide a constant average grade to the smelter. Analysis of samples from various benches gave these results:

The top bench gave.....	3.90 o/o Cu
The intermediate bench gave...	8.80 o/o Cu
The lowest bench gave as an average	12.60 o/o Cu

Covellite, the mineral typical for supergene enrichment, is found in economically important quantities, not only in the lower massive pyritic part, but also in the lower disseminated ore. The above figures prove that there is a well defined zone of secondary enrichment.

On the other hand, activities which led to such an enrichment were of a much smaller scale than has been supposed by Behrend. He regarded all red schists on top of the deposit as one huge formation of gossan, and the massive pyritic ore formation as an intensive supergene enrichment, owing its high copper content to this leached gossan. Actually only 10-15 m. of the top of the massive ore has been leached partially of its copper content, as is clearly indicated by the above analysis.

Iron oxide content of the schists above the orebody, might be explained by great fluctuations in the level of the underground waters, caused by the semi-arid type of climate in this part of the country.

Groundwater flow is at present about 8 liters per second, and carries considerable quantities of copper and iron sulphates. Had there been any flow of underground water even very much less, say one-tenth of this discharge, it is easy to calculate that the ore would have been leached of its copper content a long time ago.

Mining is performed as an open-pit operation. The overburden of altered schist, diabase and serpentine is stripped in 10-m. high benches, by means of three diesel-powered shovels of which one to two work at a time. They have 1.4-2.4-cu.m. dippers and load into 1.5-cu.m. rocker dump cars on 60-cm. (24 in.) gage tracks. Trains are hauled by diesel-powered locos. The ratio of overburden to ore is 1.08 cu.m. of overburden in place to one m. ton of massive pyritic ore. In 1948, 209,000 cu.m. of overburden (as loose material) were stripped, and 149,000 tons of ore were mined with an average grade of 8.21% Cu. The mean slope of the stripping banks is 35-40 deg.

Actual mining is done by hand, owing to the necessity of keeping out waste and fill of the old stopes which are met at every step. Experiments with the glory-hole method proved unsatisfactory also owing to this very fact. Although standard height of benches is 10 m., intermediate benches are sometimes used. The width is 5-8m. Output at the face is 7.5 m. tons per man shift; but over-all output, including stripping, exploration and surface plant is 1.8 tons.

Drilling is done with jackhammers. The ore drills and breaks readily. Blasting is done with 92% gelatine. Consumption is about 30-40 grams per ton of ore mined. Three compressors provide air at seven atmospheres pressure. Transport of ore is effected in trains of mine cars which are drawn by diesel-locos to the smelter site.

Exploration is done by means of drifts and also a diamond core drill is used.

Smelting

Run-of-mine ore is screened on a 20-m. screen and 31-36% is obtained as fines, which amounted to 52,623 m. tons in 1948. Some of the fines (121,894 tons in 1948) are treated in a battery of Huntington-Heberlein type of sintering pots and the rest is stocked on a dump, for future treatment. The coarse sinter and the oversize from the screening plant are fed to two water-jacketed blast furnaces together with silica and limestone as flux, coke, etc.; one furnace is run at a time. The hearth dimensions are 5.6 x 1.2 m. at the elevation of the tuyeres, and over 500 m. tons of charge are run through daily. The molten product settles in a forehearth, and slag is decanted continually into special wagons and dumped. Slag loss is about 0.55% Cu. Coke consumption is only 5% of the charge, the greater part of the heat being generated by the high sulphur content of the ore, which is 46-48%.

The matte which contains 34-36% Cu is treated in three Pierce-Smith type converters of 4.5 x 3.00 m. size. Some silica, flue dust, etc., is added here with about 700 metric tons of cement copper per year which is obtained by treating the mine discharge waters with scrap iron. The product from the converters is blister copper with 99.0-99.3% Cu. Fire refined copper is obtained from treating molten blister copper in two oil-fired furnaces and is used domestically; the greater part of the copper production is exported. Production in 1948 was 10,979 tons of blister and refined copper.

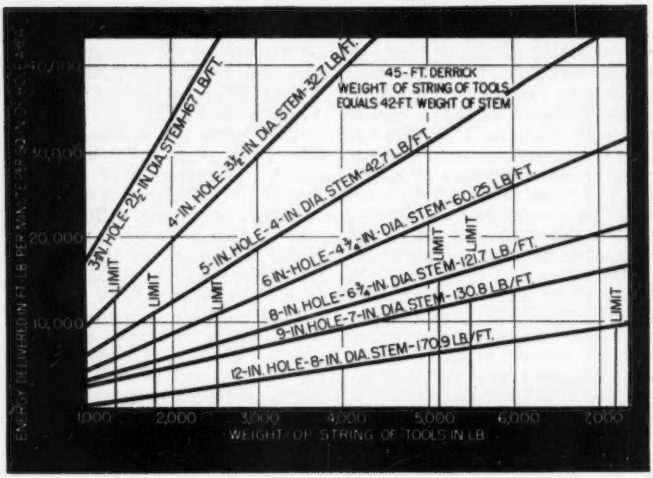
A new departure from standard treatment is the successful use of a settling furnace for treating converter slag. This practice has been found advantageous and is preferred to the standard practice of sending the converter slag back into the blast furnace.

Power Plant

The power plant consists of two steam turbo-generators of 3,000 kw. each and a 200-hp. diesel-generator aggregate. Water is provided by a pumping station from the Dicle (the Tigris River). A well-stocked storehouse has to be kept because material takes a long time to arrive. The capacity of the repair shops is unproportionately great, because most of the machinery spares had to be manufactured on the site, owing to the fact that the greater part of the equipment is of German design and replacements could not be obtained during the war. The rest of the installations such as Roots blowers, compressors, cranes, etc., are the usual sort used in smelter operations, except for an oxygen plant and a wagon lift for the standard railway wagons with a side track that joins the smelter site to the main railway line.

A new mill with a flotation plant is now being built by the Western Knapp Co. of San Francisco, which will treat 300 m. tons daily of fine sulphide ore or low-grade ore of the disseminated type.

The greater part of the labor is obtained locally. The total number of employees (including staff) at the entire property numbers around 1,700.



THIS CHART HELPS TELL YOU. Crushing energy per sq. in. of hole area, delivered at bottom of hole, is basis for comparison. See text for examples.

Selecting the Best Size of Hole for Churn Drilling

N. NIXON
Chief Engineer
Keystone Driller Co.
Beaver Falls, Pa.

TO DETERMINE what is the most advantageous size of hole for a churn-drilling job, one should know the performance characteristics of the drill and study the factors involved. In quarry operations, the fragmentation characteristics of the rock formations also must be studied in relationship to the most economical size of hole.

Factors that hinder the drilling of a churn-drill hole are wall friction, the displacement of air and water by the string of tools, and the cushioning of the cuttings accumulated at the bottom of the hole. Their effect is small.

The important factors in making a hole in rock are: the weight of a string of tools in pounds, the length of the stroke in feet, and the number of blows per minute delivered at the bottom of the hole.

The product of pounds times feet measures the available work or shows the strength of a single blow. On the rate of delivering these blows depends the amount of crushing energy delivered at the bottom.

The total-energy value varies greatly and provides no common ground for hole-to-hole comparison. However, intensity of the total energy per square inch of the hole area gives a good measuring stick for revealing the economies of holes of different sizes. To determine the total energy per square inch of the hole is the first step in searching for a common ground for hole comparison. It should be supplemented by a few assumptions.

In this discussion, the derrick for all sizes of holes is limited to 45 ft. in height.

We have also classified all spudding-type, or churn, drilling machines, now available on the market, in two groups; one of small machines engaged in drilling small sizes of holes up to and including 6 in. These machines would have a 2.17-ft. length of stroke, measuring it at the ground surface, and would be capable of delivering 56 strokes per minute. The second group, comprising larger machines, would drill holes larger than 6-in. diameter with 2.83 ft. of stroke and at 52 blows per minute.

The accompanying table shows data for different sizes of holes. To illustrate these data graphically, the total energy per square inch was plotted vertically and the

Drilling Different Diameter Holes With Different Weight Tools

Hole Size, In.	Weight of Tools Lb.	Strokes Per Min.	Area, Sq. In.	Pressure Lb. Per Sq. In.	Energy Ft. Lb. Per Sq. In. Per Min.	Total Energy Ft. Lb. Per Min.	Energy Per Stroke Ft. Lb.	Stroke Length, Ft.
3	500	56	7.06	71.0	8,600	61,000	1,080	2.17
3	1,000	56	7.06	142.0	17,100	121,000	2,170	2.17
3	1,500	56	7.06	213.0	25,600	182,000	3,260	2.17
3	2,000	56	7.06	284.0	34,200	242,000	4,350	2.17
4	500	56	12.55	40.0	4,850	61,000	1,080	2.17
4	1,000	56	12.55	80.0	9,650	121,000	2,170	2.17
4	1,500	56	12.55	120.0	14,500	182,000	3,260	2.17
4	2,000	56	12.55	160.0	19,300	242,000	4,350	2.17
5	1,500	56	19.60	76.5	9,230	182,000	3,250	2.17
5	2,500	56	19.60	127.2	15,500	303,000	5,410	2.17
5	3,500	56	19.60	178.5	21,700	425,000	7,570	2.17
5	4,500	56	19.60	229.0	27,700	545,000	9,730	2.17
6	1,500	56	28.30	53.0	6,400	182,000	3,250	2.17
6	2,500	56	28.30	88.5	10,700	303,000	5,410	2.17
6	3,500	56	28.30	123.0	15,000	425,000	7,570	2.17
6	4,500	56	28.30	158.5	19,250	545,000	9,730	2.17
8	1,500	52	50.00	30.0	4,430	222,000	4,250	2.83
8	2,500	52	50.00	50.0	7,370	369,000	7,070	2.83
8	4,500	52	50.00	90.0	13,250	663,000	12,700	2.83
8	5,000	52	50.00	100.0	14,700	735,000	14,100	2.83
9	1,500	52	63.50	23.6	3,500	222,000	4,250	2.83
9	2,500	52	63.50	39.3	5,800	369,000	7,070	2.82
9	4,500	52	63.50	70.7	10,450	663,000	12,700	2.83
9	5,000	52	63.50	78.7	11,600	735,000	14,100	2.83
12	1,500	52	116.00	12.9	1,910	222,000	4,250	2.83
12	2,500	52	116.00	21.6	3,190	369,000	7,070	2.83
12	4,500	52	116.00	38.8	5,720	663,000	12,700	2.83
12	5,000	52	116.00	43.2	6,330	735,000	14,100	2.83

weight of the string of tools was plotted horizontally.

A series of lines was thus obtained for each different size of hole. Each line shows the variation of total energy per square inch delivered at the bottom of the hole against the weight of the tools used.

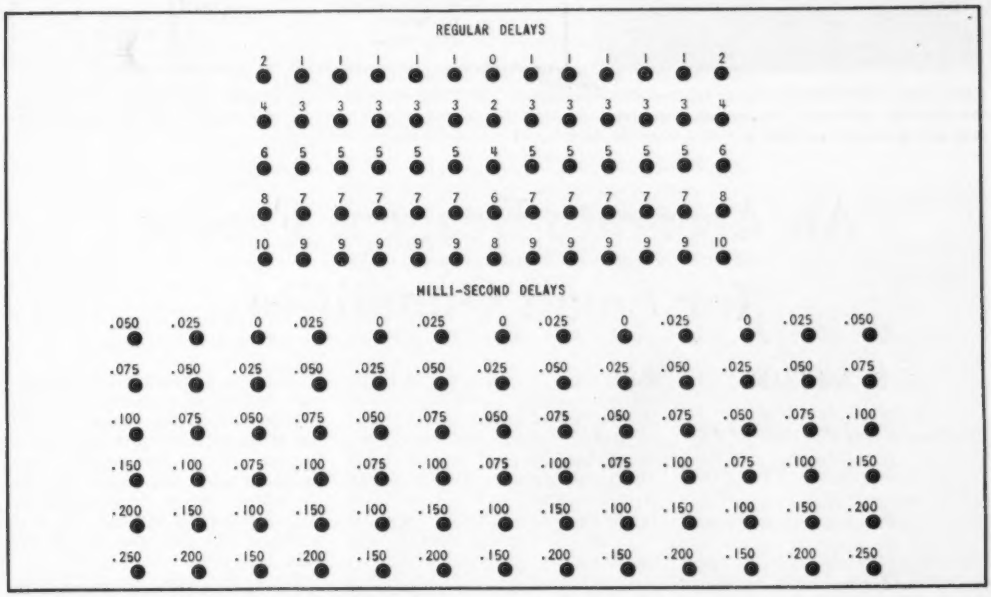
The maximum weight of the string of tools for each hole is limited by the height of derrick assumed, and the corresponding energy delivered is shaded away to emphasize these limits. Looking at the data graphically presented, we see that 3,000-lb. weight of tools is the top limit for small holes, including 6-in. holes, while 4,000 lb. is the beginning of the tool weight for holes 8 in. and larger, provided that about the same amount of total crushing energy per square inch at the bottom of the hole is the goal.

For the same weight of tools, smaller holes have a much greater amount of crushing energy delivered than the larger holes. This characteristic of smaller holes should not be overlooked. However, their usefulness is limited by the derrick height and the vibration factor in the string of tools.

Considering the 12-in. hole, the largest shown, one sees that 6,000 lb. of tools is about the right weight for delivering a series of crushing blows of a significant force and effectiveness.

Also from the graph, the answer can be found as to what is the most economical weight of tools with the spudding types of drilling machines. The answer is that the more the crushing energy per square inch, the more penetrating footage may be expected.

This theoretical analysis is in close agreement with practical results obtained and published in "Mining Engineering" by G. J. Ballmer, superintendent, Chino Mines Div., Kennecott Copper Corp., Santa Rita, New Mexico, and we quote, "The drilling rates are about as follows: 9-in. rigs, 10.5 ft. per hr. drilling; 12-in. rings, 8 ft. per hr. drilling."



BETTER FRAGMENTATION AND NO BOOTLEGS resulted when Balmat changed from the round shown at top, using regular delays, to the round shown below, using milli-second delays, in cutting a new pump sump.

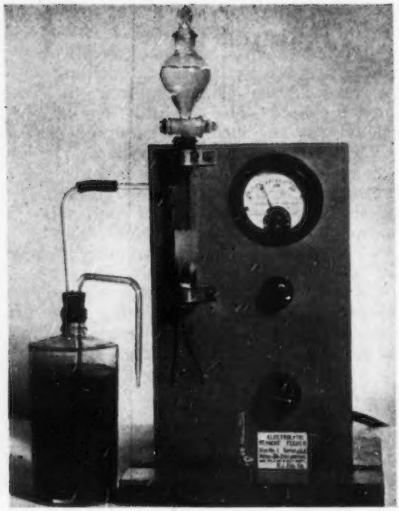
Fast Delays Improve Blasting at Balmat

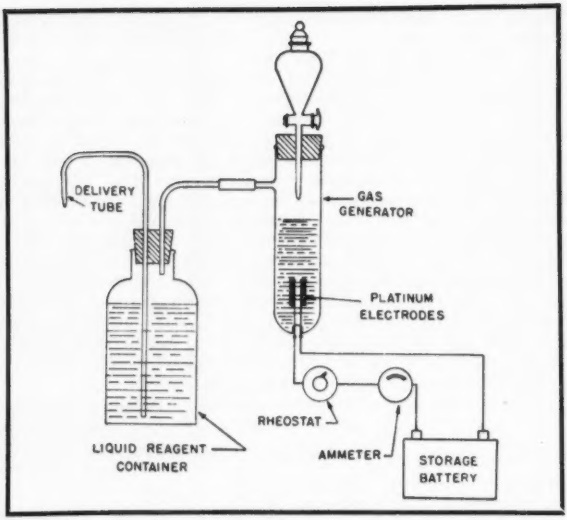
IN STOPING and similar operations, St. Joseph Lead Co., at Balmat, N. Y., has found that, by using short-period, or milli-second, delays in blasting, "hole robbing" can be prevented and better fragmentation obtained, according to Marshall G. Jones, manager. This is illustrated by the following example:

In cutting the 1,300-ft level pump sump, two sections were excavated which are approximately 150x24 ft. and 16 ft. high. An 8x8-ft. drift was driven on the center line of these sumps and later was slabbed out to 24-ft. width. The back of this sump was taken down by drilling 8-ft. vertical holes on 2-ft. centers with stopers. The idea in spacing the holes with little burden was to prevent breaking oversize material difficult to handle.

The first section of the sump was blasted with regular delay caps, and 65 holes were fired at a time. The results were not too encouraging, as several holes were cut off, leaving large chunks with powder in them after each blast.

Milli-second delays were used on the second section of the sump, 78 holes being fired in each blast. The fragmentation was such that no difficulty was had in disposing of the waste. All holes broke to bottom and no cut-off holes occurred.





REAGENT FEEDER, close up at left and shown schematically in Fig. 1 at right, consists of three parts—a single-tube gas generator in which acidified water is electrolyzed to yield oxygen and hydrogen, a panel for controlling current from storage battery to generator for electrolysis, and the reagent container.

An Accurate Reagent Feeder for Small Quantities

A. O. ASHMAN
Technical Department
The New Jersey Zinc Co. (of Pa.)
Palmerton, Pa.

WHILE CONDUCTING A SERIES of pilot plant flotation tests, it became necessary to devise a means for controlling the delivery of small quantities of reagents to the cells. The ordinary mechanical types of reagent feeders, while satisfactory for larger operations, were not sufficiently accurate or constant for the small quantities. Liquid displacement by means of controlled air or gas flows proved difficult and seemingly impractical due to fluctuation in flow over extended periods. Consideration of possible means of controlling small gas flows, however did lead to an idea which seemed promising and resulted in the development of an easily controlled reagent feeder that was sufficiently accurate over the flow range encountered in small-scale testing. The idea was based on the electrolysis of water as a means of gas generation. Inasmuch as electrolytic currents lend themselves to easy and accurate control, this method of gas generation when applied to liquid displacement offered possibilities of controlled precision feeding over a wide range. Applied to small-scale flotation testing, it proved practical over a range of from 0.08cc. per minute to 15cc. per minute.

This apparatus consists of three elements: 1, a storage battery with rheostat control and ammeter; 2, the gas generator (electrolytic cell); 3, the liquid reagent container with delivery tube. It is shown schematically in Fig. 1 at the top of this page.

Storage-battery power is used, inasmuch as it is independent of fluctuations in line voltage. Two 8-v. batteries are supplied, permitting the charging of one while the other is in use. Battery capacity depends, of course, on the rate of reagent feeding and the number of feeders operated. Batteries that are rated at 180-amp.-hr. were found to be entirely satisfactory for the simultaneous operation of 14 reagent feeders.

The gas generator (electrolytic cell) consists of a glass tube of approximately 22-mm. bore and 20 cm. long, with an open top, closed bottom, and a side outlet. Two platinum wires are sealed through the glass bottom, terminating in copper leads on the outside, and platinum foil electrodes on the inside.

These electrodes are 0.127 mm. thick, 8.4 mm. square, and are spaced 7 mm. apart. The size and spacing of the electrodes are not critical, but major deviations will affect the over-all resistance of the circuit and may necessitate changing the characteristics of the controls.

Details of the control circuit are shown in Fig. 2. It consists of two circular slide-wire rheostats for coarse adjustment and for delicate adjustment, respectively, and an ammeter. A fixed resistance, fuse and polarity connection plug complete the circuit, all being connected in series as shown and conveniently mounted on a panel. Here again the choice of resistance values, both fixed and variable, is not critical.

The values noted in the accompanying table have been found satisfactory for the several capacities of feeders listed.

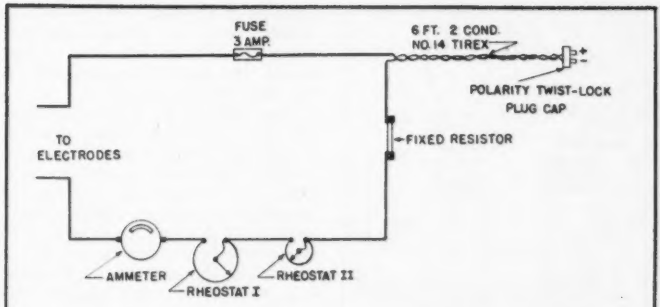
The reagent containers are bottles, or suction flasks, of suitable size to hold sufficient reagent for one day's operation or longer. The containers are equipped with stopper and glass tubing, as shown in the illustrations on page 98, and are connected to the outlet tube of the cell. The tip of the delivery tube should be kept at or above the liquid level in the bottle to avoid syphoning and be drawn down somewhat to minimize the tendency somewhat in order to minimize the tendency to form large drops at the nozzle.

In Operation

To start the feeder, the gas generator is filled with several inches of the acidified water (approximately 20% H_2SO_4), connections made to the reagent bottle, and the current adjusted by means of the rheostats to the approximate setting on the ammeter. Generation of gas proceeds as soon as the current connection is made, but some time is required to generate sufficient volume at the elevated pressure necessary to establish equilibrium conditions. The time required to reach equilibrium can be minimized by applying an initial air pressure to the system, which, when done, is introduced through the separatory funnel. After equilibrium has been established, the current setting is checked and adjusted if necessary by collecting the discharge from the delivery tube in a graduate for a reasonable period of time. Typical rates of reagent feeding are shown in in the table that accompanies Fig. 2.

Once the proper current setting has been reached, frequent attention is not required. Nevertheless due to storage battery drainage and other reasons discussed later, some attention must be given. It is considered good practice to check each feeder every two or three hours. By using a stop watch and suitably scaled graduate, checking is reduced to a simple routine. The feeder can be theoretically calibrated by using the well-established factors of gas volumes generated per coulomb or per faraday. MacInnes[1] uses a figure of 1 coulomb = 0.1741 cc. of combined volume of hydrogen and oxygen at standard conditions, which includes a correction for the reduction of water volume. Correct-

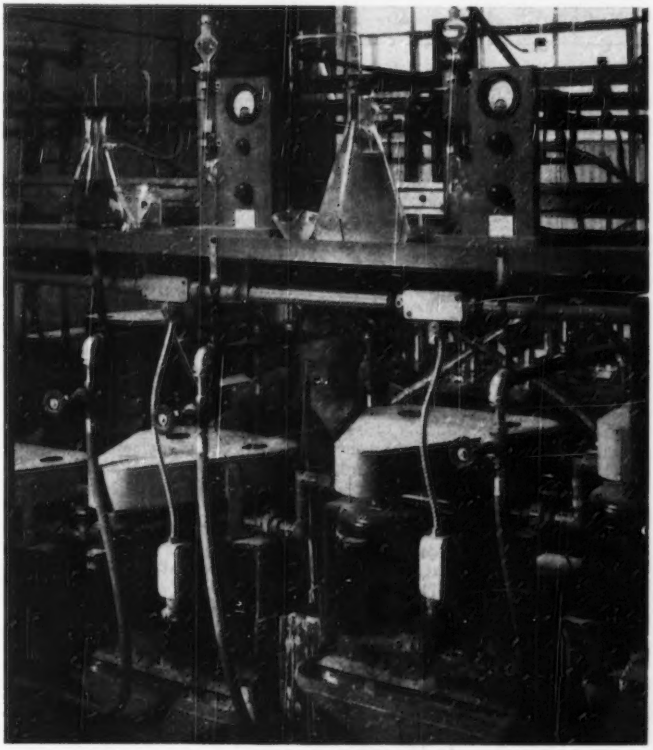
[1]The Principles of Electrochemistry, D. A. MacInnes (1939), page 36.



RATES OF FLOW	RHEOSTAT I	RHEOSTAT II	FIXED RESISTOR	AMMETER WESTON MOD. NO. 301
.08-2CC/MIN.	W.L. NO. 1108, 640 OHMS	W.L. NO. 1105, 6.4 OHMS	WL-10F 10 OHMS	0-200 M.A.
.4-5CC/MIN.	W.L. NO. 1108, 160 OHMS	W.L. NO. 1105, 4.0 OHMS	WL-10F 5 OHMS	0-500 M.A.
2.0-15CC/MIN.	W.L. NO. 1108, 25 OHMS	W.L. NO. 1106, .64 OHMS	WL-10F 2 OHMS	0-1.5 AMP.

RHEOSTATS—PAN CAKE TYPE

FIG. 2. IN THE CIRCUIT between battery and generator, two rheostats and an ammeter with a fixed resistance, a fuse and polarity connection plug control the electrolysis of the water in the generator. Satisfactory values for feeder capacities listed are given in table above.



TWO FEEDERS installed in New Jersey Zinc Co.'s pilot plant at Palmerton deliver small quantities of reagent accurately to flotation cells as required. Operation depends on electrolysis of water.

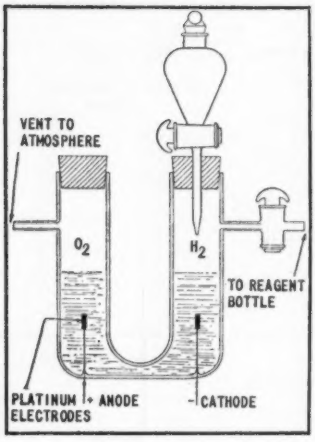


FIG. 3. MIXTURE of hydrogen and oxygen generated by electrolysis can be prevented, if desired, by using this double-arm gas generator.

ing this to average room conditions of 25 deg. C. and 750 mm. pressure, 1 coulomb = 0.1926 cc.

Electrolytic reagent feeders are apparently suitable for use with a wide variety of liquid reagents. Once equilibrium has been established, the flow is proportional to the electrolyzing current.

Inasmuch as the gases generated are subject to the gas laws, changes in feed rate result from changes in ambient temperature, hydrostatic pressure (height of the nozzle above the liquid in the reagent container), and atmospheric pressure. Temperature effects can usually be controlled, if necessary, by insulating the generator and reagent container or placing them in a thermostatically controlled box. It is well to minimize the size of the reagent container or at least the space above the liquid. Gas volume-temperature changes are evidently greater for large volumes than for small ones. The hydrostatic pressure can be compensated for by adjusting the height of the discharge nozzle with respect to the liquid height. In practice, all of these are usually negligible. Correction can be made for all of them by the employment of frequent checking, as previously stated.

Questions have been raised regarding the effect of free oxygen on certain reagents or of the possible explosive hazard of an oxygen-hydrogen mixture. In either of these cases, the objection can be eliminated by the use of a double-arm gas generator similar to that shown in Fig. 3, which prevents the mixing of the gases evolved. In such cases, only a part of the gas generated is utilized, and the current flow relations that have been previously cited must be altered accordingly.

Effect of Free Oxygen

Certain types of pigmented rubber tubing used for the glass-tube connections have been found to deteriorate rapidly, due to the presence of free oxygen. The deterioration is evident with some tubing in less than an hour. Pure gum rubber tubing is relatively inert. Fisher Scientific Co. Plastubing was found to be satisfactory. Koroseal made by B. F. Goodrich Co. and Tygonite made by U. S. Chemical Stoneware Co. are also said to be satisfactory, but no tests were made on them.

Pre-Assembled Timber Sets Speed Shaft Rehabilitation

J. B. HUTTL
Associate Editor

CALAVERAS CENTRAL Gold Mining Co., Ltd., Calaveras County, Calif., is employing the following unique methods in rehabilitating its three-compartment main shaft: (1) Installation of pumping equipment which permits rapid adjustment underground, removal for repairs, and eliminates all underground pipe work, and (2) lowering pre-assembled shaft sets and setting them in place from a movable platform. Operations are under the direction of Harry Sears, president and general manager, who released this information. Desmond Sears is assistant general manager, and Carl A. Wesselhoft, foreman.

Starting from the collar, the main shaft passes through 75 ft. of andesitic tuff, 85 ft. of brown gravel, 90 ft. of rhyolitic tuff, 20 ft. of gray gravel, 15 ft. of rhyolitic tuff, and 65 ft. of gray gravel partly cemented by calcium carbonate. Rough cross-section of the shaft is 7x14½ ft. Shaft sets are made of 4x8-in. lumber. One of the hoisting compartments is longer than the other to permit lowering of whole shaft sets. (See illustration.) It measures 4 ft. 7 in. by 5 ft. 9½ in. inside timbers, while the adjoining compartment and manway measure 4 ft. 7 in. by 4 ft. 5¾ in. and 4 ft. 7 in. by 2 ft., respectively. Hoisting will be done with a combination skip-cage unit actuated by a 200-hp. double-drum hoist. Steel hoist cable is 1⅛ in.

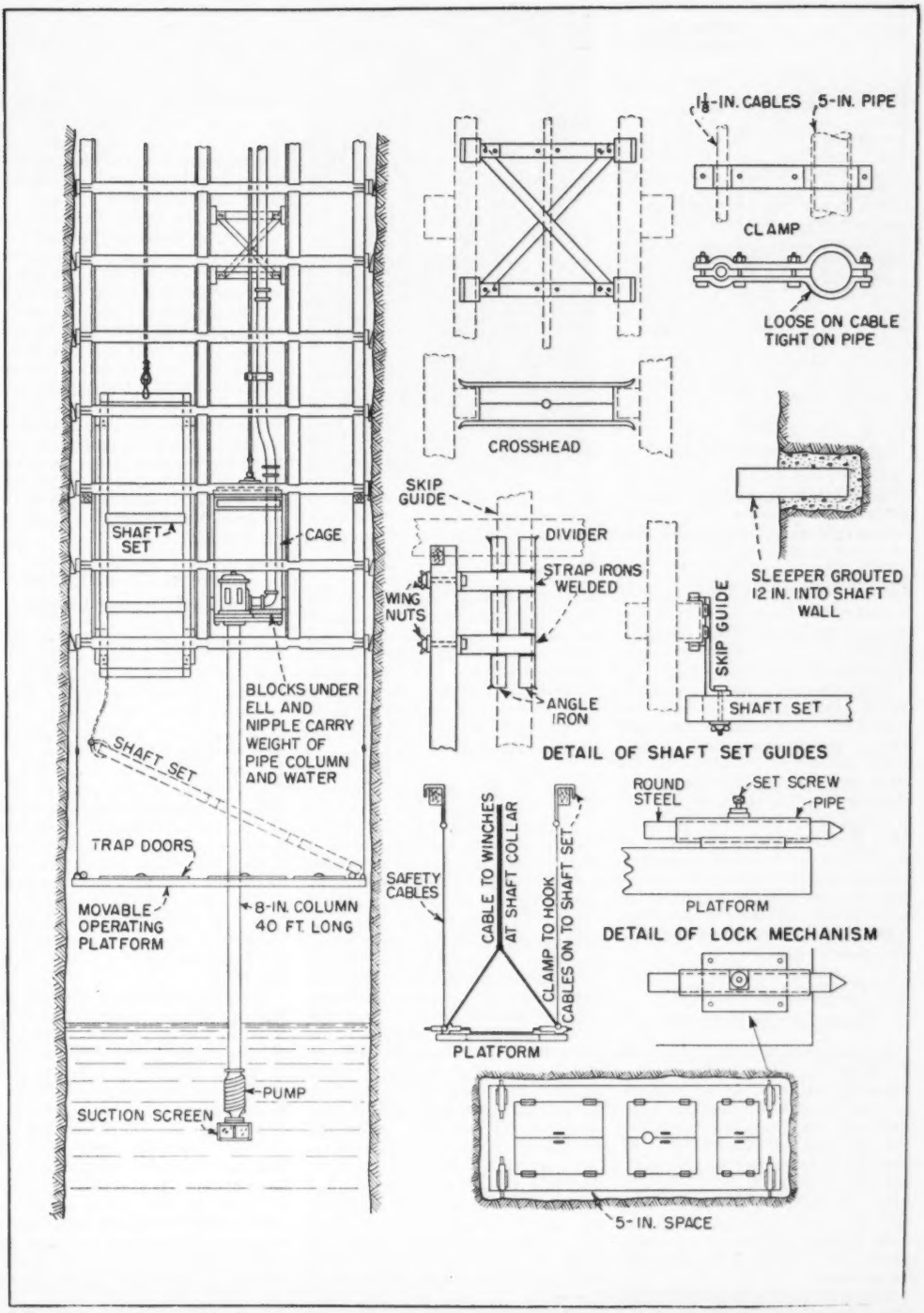
Although the cage section operating in the larger compartment is wider than that in the adjoining one, the skip sections of the units are identical in design and hold 4 tons of mined gravel.

Pre-Assembled Sets

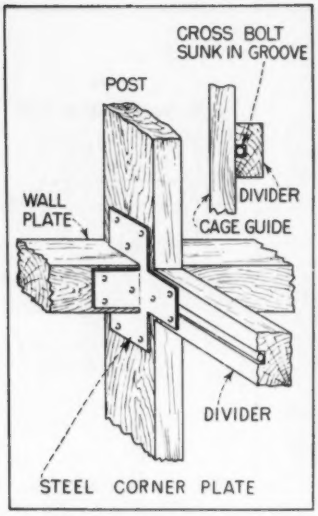
The use of 4x8-in. lumber for shaft timbering is unusual. However, by employing 4-ft. posts, which bring the shaft sets closer together, steel rod bracing and steel corner plates as shown, the overall structure is as rigid and strong as if it were made from conventional 8x8-in. timbers. Sleepers grouted into the shaft walls at 40-ft. intervals, and wood blocks between the center shaft guides midway between each shaft set add extra strength to the structure. Skip guides are oversize, of 4x8-in. planed timber.

Sets Are Lowered on Guides

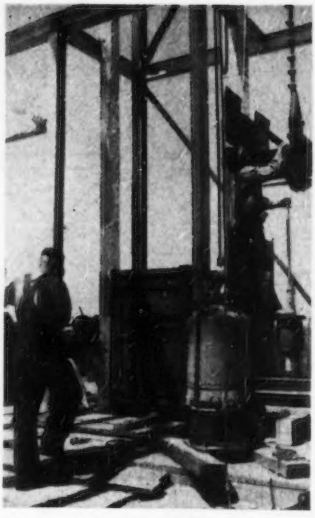
All shaft sets are assembled on the surface where jigs and templates are used to make various parts of each set. Each assembled set is then lowered with the steel guides shown. Each guide consists of two lengths of large angle iron and two welded-on flat irons. Ends of the long extensions of the flat irons are bent at right angles and are pierced with holes to accommodate long bolts with wing nuts.



PRE-ASSEMBLED TIMBER SETS are lowered in left compartment of shaft and blocked into position from hanging platform suspended by four safety cables.



STEEL CORNER PLATES add rigidity to junctures of 4x8-in. members of light-weight shaft timber sets.



PUMP COLUMN is shown attached to cage bottom. Pump motor in foreground is ready for installation.

Spacing of these holes corresponds to that of the holes drilled near the ends of each wall plate. Attachment of the shaft set before lowering takes only a few minutes.

Each wall plate also has a hole drilled in the center to hold the bolts with wing nuts of the cable rig suspended from a light telpher crane assembly installed in the lower part of the headframe and running from the shaft set storage to the collar of the shaft. The shaft set is thus brought to the collar of the shaft at the mouth of the larger hoisting compartment, and hoisted into vertical position. Then it is bolted to the steel guides operating in the regular skip guides and lowered underground.

Guides Are Installed From Safety Platform

At the point of destination, the set is lowered into a horizontal position for setting. Actual setting is done from a wooden platform fitted with trap doors and lock bolts. The platform is attached to two steel cables extending to two hand winches at the collar of the shaft. After the platform has been lowered to the desired position, the hooks of four additional cables are placed over the end of the platform for safety.

Before the shaft set can be finally placed, the sinking pump must be raised out of the way. First the pump is stopped by removing the plug from the starter box, then it is raised 12 to 15 ft., and lowered again after the shaft set has been raised to the point of installation. Close cooperation between hoistman and shaftmen on the platform is afforded by an electronic voice intercommunication system.

Pumping

Pumping equipment used in dewatering operations consists of a 9-stage B-J deep well pump driven by a 60-hp. U. S. motor capable of delivering 650 gpm. against a head of 280 ft. The 8-in. pipe column between the pump and motor is 40 ft. long. The outstanding feature of the pump arrangement shown is that the pump unit and discharge pipe column can be raised or lowered together at any time. All pipe work and repairs can be done on the surface. This has been made possible by installing the pump at the bottom of the regular man cage and running the 5-in. discharge pipe alongside up to the shaft collar. Split crossheads installed at 40-ft. intervals and steel spacer clamps give stability to the pump discharge column and prevent excessive vibration. The crossheads are bolted tight to the 1⅛-in. hoist cable, while the clamp section embracing the cable is loose and that embracing the pipe is tight. This obviates stress on the cable. Blocks under the 8-in. pipe nipple extending from the pump motor frame and Ell carry the weight of the pipe column and the water therein.

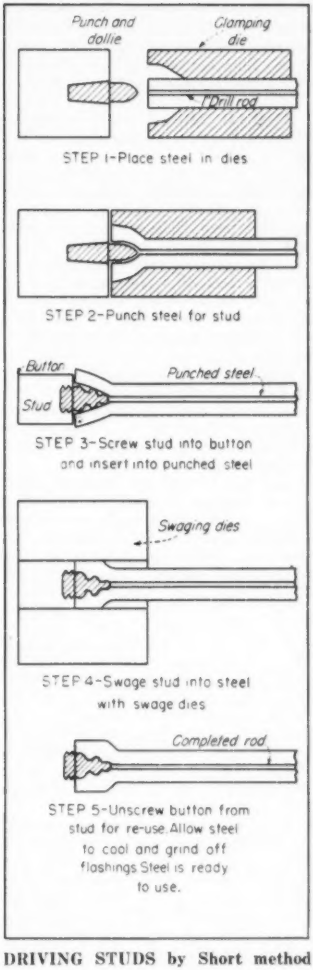
The complete pump unit, pipe column, water, and cage weigh about 3 tons (at 300 ft. depth), and cable stretch is a little more than 1 in. As the water level falls in the shaft, the pump is lowered correspondingly and new pipe sections are added to the pump discharge column at the collar of the shaft. At this point they are also disconnected and removed when the pump assembly must be raised more than 85 ft. —the distance of open space between the shaft collar and the platform at the top of the headframe containing the two sheave wheels. When the pump assembly has been lowered to the desired point of operation, the hoist brakes are locked, and as an extra precaution a heavy, iron-shod wooden beam is pulled through the cable drum between two spokes, the ends resting on the concrete foundation walls alongside the drum.

Calaveras Central's Plans Call for Increased Output

Calaveras Central Gold Mining Co., Ltd., is being rehabilitated and equipped for a daily production of 600 to 800 tons per day of gold-bearing gravel. The property is of special interest because it is the largest drift gravel mine in California, covering some 3½ miles of the Central Hill channel of the main Tertiary Calaveras River. During past operation the management has pioneered in the use of modern equipment and engineering methods to produce large tonnage at low cost. Production prior to 1931 was about 2,000 oz. of gold. Since 1931 until the wartime shutdown production was more than 20,000 oz.

Plant improvements planned by the management, but postponed because of the war, included erection of a steel headframe over the 350-ft. main shaft, new hoisting and compressor equipment, and a 600 to 800-ton gravel treatment plant. Recently an 85-ft. steel headframe, 200-hp. hoist has been installed and new surface buildings have been erected. Another shaft, known as the Aetna, 240 ft. deep and about 900 ft. southeast of the main shaft, was rehabilitated and equipped recently. The rehabilitated Aetna shaft will serve as a supply shaft and as a ventilation shaft and emergency exit required by California law.

KEEPING TAB ON PRACTICE


Punch and dollie
Clamping die
Drill rod
STEP 1-Place steel in dies
STEP 2-Punch steel for stud
Button
Punched steel
Stud
STEP 3-Screw stud into button and insert into punched steel
Swaging dies
STEP 4-Swage stud into steel with swage dies
Completed rod
STEP 5-Unscrew button from stud for re-use. Allow steel to cool and grind off flashings. Steel is ready to use.

DRIVING STUDS by Short method requires the five steps shown here.

Longer Life for Carbide-Bit Studs. Joe Short, foreman of Howe Sound's steel shop at Holden mine, has devised a method of driving studs for Carset bits into the rod for long-hole drilling that has practically doubled the life of the studs at the mine. Lacking the equipment suggested by the manufacturer when tests with the 1½-in. bits began, he worked out the method now known by his name. The resulting rod has been adopted for general mine use.

The Short method, according to E. A. Youngberg, Holden research engineer, is as follows: The steel is first punched to take the stud. To form the rod face, a button about 1½-in. long, of the same diameter as the bit skirt, is made. The stud is then screwed into the button and its opposite end inserted into the punched steel. The steel is next swaged down around the stud, the excess metal in the shoulder being forced forward against the face of the button screwed on the stud to form a seat for the bit. Success depends on the amount of steel left in the shoulder after punching and on the size of the swaging dies. Flashing from forging is ground or machined off; and, on 7-ft. rods, the shoulder around the stud is machined down in order to give extra clearance for the bits of smaller gage.

Stud and rod are not heat-treated following the swaging. The swaging is started with the steel at 1750° to 1800° F. When done, the steel is allowed to cool in air. After facing, it is ready for mine use.

Success of the method appears to be due to the fact that the steel is swaged around the stud in a more or less drawing action. In the standard method the steel is upset, causing wrinkles and strains which cannot be removed by heat-treating. Another important feature is that the stud is not heat-treated. This leaves it in about the same condition as when purchased. The steel around the stud, although not as hard as desired, holds the stud well. Possibly, when the steel is swaged around the cold stud, some hardening next to the stud is obtained. Breakage comes usually in the rod close to the second bump on the stud. This is the most desirable point for failure as it is least likely to damage the bit.

What Rope for Hoisting? Recently, a rope was taken off the skip hoist at a northern Michigan iron mine that has outworn any rope used in the company's many mines. After 21 months' continuous service on the cage, it was shifted to the skip hoist where it raised 1,326,000 tons of ore, a record. Descriptive details are: 1⅞-in. diameter, 6x27 Bethlehem Type H, purple, Lang lay, left lay, hemp-center, flattened-strand. Can any mining company top this record?

Chain Feeder in Block-Caving Transfer Drift. E&MJ in its Feb., 1949, issue, p. 104, described the trial use, in connection with block-caving, of a portable chain feeder in a transfer drift for receiving ore from the stope raises and delivering it to a belt conveyor in the drift. The idea leading to the installation was that the feeder would take the impact of the ore and get the ore in motion in the direction of belt travel before feeding it to the belt. This feeder, the management said recently, did good work in loading the belt with little maintenance, after initial adjustments had been made in its speed and the shape of its discharge end. The single disadvantage, which had nothing to do with it or the conveyor, was that the large amount of retimbering in the semi-soft transition material under the block made it difficult to maintain an opening large enough to move the feeder to the various positions necessary. This compared unfavorably with the ease with which a scraper transfer could be operated under the block even when the drift was rather badly crushed both from the back and the sides.

Better Communication for Open Pits. Use of radio equipment in open pit work appears to be increasing. Three instances are noted: Two-way equipment has been placed in the truck of every foreman and in tower cars used in trolley work at a Southwestern copper mine. The installation includes a 30-watt Motorola fixed station, and eleven 7-watt mobile units. All locomotives will also be radio-equipped. The new practice has speeded up operation. Foremen now can keep in touch with each other and learn of changes immediately. The tendency has been to cut down the length of operating delays.

Radio equipment has also been installed on the locomotives in a large pit outside the United States. Details are expected soon. Use of walkie-talkie sets at a Western mine is also reported.

New Carbide Bit in Four Series. When E&MJ's February Survey of Mining Practice was being prepared, data regarding Timken's detachable carbide bit were not available. A 12-page bulletin describing it, in four series, has just been received. The bit in general is of the four-point cross type and has one center and two side holes. The four series are designated respectively as "FC" (⅞-in. thread), "MCA" (1-in. thread), "MC" (1-in. thread), and "DC" (1 3/16-in. thread). Each series includes several gage sizes. Incidentally Timken has no bit designated as the "Asterisk" bit. The term as used in certain comment from the Iron Country was evidently due to a misunderstanding.

WASHINGTON REFLECTIONS

Seabrook Hull, McGraw-Hill Washington News Bureau

House Kills Incentive Payments

S. 2105, the O'Mahoney mine incentive payments bill, was debated in the House on Mar. 16 and defeated, 166 to 144. It passed the Senate several months ago. Reasons for its failure boil down to two basic facts. First, the economy wave in Congress is gaining strength. Second, there was too little support from the mining industry. Many Congressmen, undecided until the final debate, could have been swayed in favor of the incentive payments plan by letters from their constituents. They didn't get them. Consensus is that this type of legislation has no further chance in this session of Congress.

Actually, when the final vote came, Western Congressmen found themselves alone. The bulk of the opposition came from the East and the South. One Congressman, discourged by the bill's defeat, stated: "If Western Congressmen would vote against agricultural subsidies a couple of times, we might get some cooperation." On the same day it voted down S. 2105, the House approved a measure to add 1,250,000 acres of cotton and 100,000 acres of peanuts to acreage allotments for Southern farmers, and to continue potato support prices, despite the glut of these products. The whole picture is loaded with election-year politics.

Some observers claimed that the tide turned against mining Congressmen when they refused to approve an amendment to S. 2105 requiring repayment of subsidies from future profits. (Cordon amendment.) However, the House itself voted down the amendment and a check on Capitol Hill indicated that this issue actually had little to do with the final outcome. Despite the confidence of the bill's proponents prior to the debate that the bill would pass, when the vote came the basic support for the measure just wasn't there. The lack of communication from the grass roots made too many Congressmen apathetic to the bill. They voted "economy," which is popular where it doesn't cost votes.

During the debate, the opponents made much of the viewpoint that full use of the "Buy American" provisions of the Stockpile Act would be more effective than S. 2105 in helping marginal operators.

The most persuasive argument in favor of the bill was made by Mrs. Bosone, Utah Congresswoman. She stressed the dearth of prospecting and the national interest in maintenance of basic industry.

Depletion Allowances Seem Safe

Congress isn't going to tamper with depletion allowances this year. In fact, the fight developing now revolves around whether a Congressional committee should or should not conduct a full-dress investigation of percentage depletion later on. Those for a change in the depletion laws want Congress to investigate. Oil and mining people would rather leave well enough alone, and they'll probably have their way.

Congress is going to cut excise taxes by $1.1-billion. The 3% excise tax on freight will be included in the reductions. About $250-million of the cut will be made up through minor tax increases.

There is a plan—the Mills bill—to speed up collection of corporation taxes by requiring payments in two periods a year rather than one. Its appeal rests on the fact that it would swell fiscal 1951 receipts with cash that normally isn't due until fiscal 1952. With the benefit of this technique, Congress could cut excise taxes, not make up for revenue thus lost, and still not create a bigger Federal deficit this election year. This is simply a piece of shallow hypocrisy.

The tax bill as written may be headed for a Truman veto, but Congress is confident of overriding.

Probable ECA Cuts Will Affect Mining

Pressure has been mounting on Capitol Hill for a further cut in foreign aid. It could be as much as $500-million below Hoffman's estimates of third-year aid requirements. A reduction of this magnitude could easily knock another $20-million off funds set aside for the purchases of nonferrous metals in the U. S.

Probably foreign aid will be cut this year, maybe as much as one-half billion dollars. Any across-the-board budget reductions will hit ECA. If more dollars are appropriated for defense—a likely probability—most of the difference will come out of foreign aid. Price reactions and fears of foreign competition, plus the failure of ECA to pull any new rabbits out of the hat or to make headway on its much publicized goal of European unity are reducing the popularity of foreign aid.

Meanwhile, present ECA plans are to finance about $250-million worth of non-ferrous metals purchases from all sources in fiscal 1951. That will be $10-to-$15-million below this year's forecast total of $265-million.

A cut in foreign aid means a cut in U. S. hard-goods exports, including U. S. sales abroad of non-ferrous metals. Present ECA-financed exports of non-ferrous metals are running close to $60-million a year. Next year—fiscal 1951—they're expected to drop to $55-million. This assumes ECA Administrator Paul Hoffman will get the $2.9-billion he's asking for. If he doesn't the drop will be even greater. However, the $1-billion the House is trying to set aside for U. S. agricultural surpluses, and the $690-million which seems destined to be earmarked for a currency clearing union wouldn't (if passed) in themselves effect the dollars that will go to non-ferrous metals.

Bulk of western Europe's non-ferrous metals purchase next year outside the U. S. will be in Canada and South America, with Yugoslavia getting a bigger share of the business than at present. If ECA financing fails, a large share of the metal that would normally flow to Europe will be offered to the U. S. market, with probably a depressive impact on prices.

Brief, But Important

COPPER TARIFF—Rep. James T. Patterson's (R., Conn.) bill to extend the copper tariff waiver for another two years is still before the House Ways and Means Committee. No hearings have yet been scheduled, but the

Committee has asked interested Government agencies to make recommendations. Treasury and Commerce did so. They want no tariff on copper. However, House Ways and Means can't take any action until it finishes the tax bill, and may forego action in the rush to go home for campaigning. Odds are in favor of defeat of this measure, unless the copper tariff advocates get lazy and fail to impress their views on Congress.

SILVER PURCHASE REPEAL Rhode Island Senator Green's S. 2829 to repeal legislation relating to the purchase of silver may come to a vote this year. The Senate Committee on Banking and Currency has scheduled hearings on it for "sometime in April."

BASING POINTS—As we went to press, legalization of delivered pricing looked like a sure thing. Senate-House conferees had ironed out their differences; the House had passed the compromise measure and the Senate appeared ready to act. Thus after two years, freight absorption and delivered pricing, widely practiced in the selling of metals, will again be legal, though this time with reservations. Under the new law, the Federal Trade Commission can ban practices which it decides might lessen or injure competition.

TAX INCENTIVES—Rep. Walter Baring's (D., Nev.) Bill (H. R. 6896), to declare a five-year moratorium on corporation taxes and on taxes of dividends from new mining enterprises still waits on hearings to be held before the House Ways and Means Committee. Action is unlikely unless the Senate amends the tax bill to do something for mining.

ALUMINUM TARIFF DISCORD—At press time, Aluminum Company of America was undecided on supporting Reynolds Metals' demand for higher tariffs on aluminum. Reynolds made a good case before the Tariff Commission, but the outlook for favorable action on its request isn't good.

WARTIME CLAIMS—Attempts are still being made to force Rep. Clair Engle's (D., Cal.) H. R. 834 out of the House Judiciary Committee. It would reimburse miners who suffered losses trying to supply critical materials during the war. This legislation, vetoed by President Truman last year on the recommendation of the Justice Department, has been bottled up in committee since July.

LEASERS FIGHT TO LIVE—On Mar. 9 operator representatives and leasers from Grass Valley, Calif., Cripple Creek, Colo., Utah, and Idaho told the Senate Finance Committee that inclusion of leasers—who are in fact independent contractors—into the proposed Social Security measure, H. R. 6000, would be ruinous to hundreds of leasing operators in the West, and would curtail mining which is only economic under the leasing system.

Attack Is Pending on Munitions Board Policies, As Agency Seeks New Funds

Western Congressmen are going to be tough on Munitions Board officials when they ask for new funds for fiscal 1951.

Here are some of the questions Congressmen are going to want answered:

Why doesn't the Munitions Board spend more money in the U. S. and less abroad? It came out in the final debate on S. 2105 that only one-third of the funds spent or committed so far have been spent in the U. S.

What reason has the Board for not using the "Buy American" clause in the stockpiling law to a greater extent? This provision allows stockpile materials to be bought in the U. S. at prices as much as 25% above the going market, if necessary. This section was inserted to support at least a nucleus of domestic production around which to expand in wartime.

Pressure will be strong to force the Munitions Board to adhere more thoroughly to this section of the law when the Board comes up for new funds. This is especially true after the setback mining Congressmen suffered when S. 2105 was defeated.

The Munitions Board will defend its policy of favoring domestic production, where available, but not paying premium prices on the grounds that it has an obligation to get the most for the taxpayers' money.

Meanwhile, the Munitions Board's 1949 stockpile report to Congress complains of too little money too late. It blames confusion over last year's appropriations, plus finally, a $100-million cut in contract authority (for future delivery) for unnecessarily imperiling national security.

The Munitions Board appropriation is of great interest to the mining industry because of the large tonnages of minerals purchased by this agency. If its buying program should be discontinued, there would unquestionably be drops in at least copper, lead, zinc, tungsten and tin prices, and probably in aluminum, manganese and chromite, as well as several minor minerals.

At the close of calendar 1949 the stockpile had $1,149-million worth or 30% of the total critical list on hand. Another $416-million or 11.1% were on order. Appropriations for the present fiscal year will enable completion of 53.7% of the total stockpile.

Currently the whole stockpile program is under review. Two new commodities have been added, aluminum, and asbestos (crocidolite). Goals have been revised on eleven others: metallurgical chromite, manganese, rubber, tin, abaca, sisal, corundum, Kyanite, talc, quebracho, and opium.

Some targets have been raised; others lowered. A few commodities may be stricken from the list. The net effect will be upward, however, as now revised, the eventual total (at going prices) value of the stockpile has now been raised from $3,217-million to $3,773-million.

LABOR THIS MONTH

JOSEPH M. GAMBATESE
Washington Bureau, McGraw-Hill Publishing Co.

● **It's clear now** that the metal and non-metallic mining industry will find its employees represented before long by such oddly assorted union groups as steelworkers, shipbuilders, coal miners, oil and chemical workers, auto workers, and just workers in general. Metal mine management is in for some heavy going next year. For details, see the article beginning on page 73.

● George Morris, labor editor of the Communist Party's newspaper, the *Daily Worker*, took a whole column recently to praise the Mine, Mill and Smelter Workers union, late of the CIO. It was the least he could do for an old friend.

● If Philip Murray's United Steelworkers union winds up on top in metal mining, as seems likely, it means an end to communist interference in the industry. But it also means dealing with a big-time union whose political power in Washington is tremendous. There's small comfort in that prospect.

● Average hours worked and earnings in the metal mining industry declined during 1949, although they went up last year in manufacturing. Weekly earnings at the end of 1949 averaged $63.51, against $65.50 at the end of 1948. The average work week was an hour shorter, 42.2 hours against 43.3. Metal miners averaged $1.50½ per hour at the year's end, a drop of less than a cent during the year. These, and the following figures are from the Bureau of Labor Statistics.

	Av. Weekly Earnings		Av. Weekly Hours		Av. Hourly Earnings	
	Dec. 1949	Dec. 1948	Dec. 1949	Dec. 1948	Dec. 1949	Dec. 1948
Iron miners	$61.74	$62.45	41.8	41.6	$1.477	$1.502
Copper miners	$64.26	$70.36	42.5	46.0	$1.512	$1.530
Lead and zinc miners	$68.26	$67.77	43.2	43.3	$1.580	$1.569

MARKETS – Trends and Prices (*Continued from page* 69)

U. S. Lead Consumption—1948 and 1949

Use of primary and secondary lead in the United States in 1949, based on preliminary data obtained by the Bureau of Mines, decreased in every product, compared with 1948, with the exception of casting metals and tetraethyl fluid. Apparent consumption in 1948 and 1949, in tons, was as follows:

	(a) 1948	(b) 1949
Metal Products:		
Ammunition	49,635	24,110
Bearing metals	42,594	28,536
Brass and bronze	23,239	13,807
Cable covering	171,654	125,406
Calking lead	31,473	31,355
Casting metals	8,974	11,804
Collapsible tubes	11,071	8,672
Foil	3,203	2,503
Pipes, traps and bends	39,843	29,410
Sheet lead	31,559	26,257
Solder	71,025	61,126
Storage batteries (lead)	203,869	151,676
Storage batteries (oxides)	150,536	117,213
Terne metal	3,278	2,823
Type metal	26,279	20,651
Totals	868,232	655,349
Pigments:		
White lead	30,970	18,378
Red lead and litharge	80,356	63,542
Other	31,062	19,096
Totals	142,388	101,016
Chemicals:		
Tetraethyl lead	83,809	94,644
Miscellaneous	10,280	4,191
Totals	94,089	98,835
Miscellaneous Uses:		
Annealing	6,132	4,126
Galvanizing	1,995	708
Lead plating	2,274	763
Weights and ballast	6,290	4,137
Totals	16,691	9,734
Other uses, unclassified	12,495	10,436
Totals consumed	1,133,895	875,370

(a) Final figures. (b) Preliminary.

Official London Prices

The British Ministry of Supply continues to fix delivered prices of copper, lead and zinc for the United Kingdom. Quotations in effect as March ended were as follows:

	Per Long Ton £	s.	d.
COPPER:			
Electrolytic, high conductivity	153	0	0
Fire refined, high conductivity	153	0	0
Fire refined, high grade	152	10	0
Fire refined, min. 99.7 percent	152	0	0
Fire refined, min. 99.2 percent	151	10	0
Hot rolled black wire rods (a)	162	11	3
LEAD:			
Soft, foreign duty paid	84	0	0
Soft, Empire	84	0	0
English, refined	85	10	0
ZINC:			
Foreign (G.o.b.) duty paid	89	10	0
Domestic (G.o.b) duty paid	89	10	0
Prime Western and debased	89	10	0
Refined and electrolytic	90	5	0
Minimum 99.99 percent	91	15	0

(a) English rods.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

(March 31, 1950)

Aluminum, ingot, 99 plus percent, lb. (base price)	17c.
Antimony, spot, lb., 5 tons and up but less than carload, in cases	27.780
Bismuth, ton lots, lb.	$2.00
Cadmium, commercial sticks, delivered, lb.	$2.00
Calcium, lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.07
Cobalt, 97 to 99 percent, per lb.	$1.80
Indium, troy oz.	$2.25
Nickel, cathodes, lb., f.o.b. Port Colborne (a)	40c.
Magnesium, 99.8 per cent, carloads, lb., producer's plant	20½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$86.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$71.00
Selenium, 99.5 percent, lb.	$2.00
Silicon, minimum 97 percent, spot, carloads, lb.	16.50c.
Tellurium, lb.	$1.75 nom.
Thallium, 100 lb. or more, lb.	$12.50
Titanium, 96 to 98 percent, lb.	$5.00

(a) Includes U. S. duty

METALLIC ORES

Beryllium Ore, imported, 8 to 12% BeO, per unit	$26.00@$30.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 48% Cr_2O_3, 2.8 to 1 ratio	$22.50
48% Cr_2O_3, 3 to 1 ratio	$25.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$8.10
Mesabi bessemer	$7.85
Old Range non-bessemer	$7.95
Mesabi, non-bessemer	$7.70
Lead (Galena), 80 percent, Joplin, Mo., ton	$126.07
Manganese Ore—Per long ton unit of Mn basis 48 percent manganese, nearby positions, subject to premiums and penalties, 74 @ 76c., c.i.f. U. S. ports, duty extra. Long-term contract prices nominal.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	54c.
Tantalite, 60% concentrate, per lb.	$2.00@$2.75
Tungsten Ore, per unit of WO_3	
Foreign, 60 percent, duty paid	$19.00@$19.25
Domestic, scheelite, 60 percent and upward	$28.50
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	27½c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$39.00

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl. carload lots delivered	5½c.
Cobalt Oxide, 72%, metallurgical grade, per lb. of Co	$1.95
Copper Sulphate, 100 lb.	$7.00

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of contained Be	$24.50
Ferrochrome, 65 to 69 percent, per lb. of Cr contained	20.50c.
Ferromanganese, 78 to 82 percent, gross ton, seaboard	$172.00
Ferromolybdenum, 55 to 65 percent Mo, lb. of Mo, contained	$1.13
Ferrosilicon, 50 percent, per lb. of contained Si	11.3c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$2.35
Ferrovanadium, per lb. of V delivered	$2.90
Silicomanganese, 1¼ percent C, per lb. contracts	8.95c.
Spiegeleisen, per long ton, 19@21%	$65.00

NON-METALLIC MINERALS

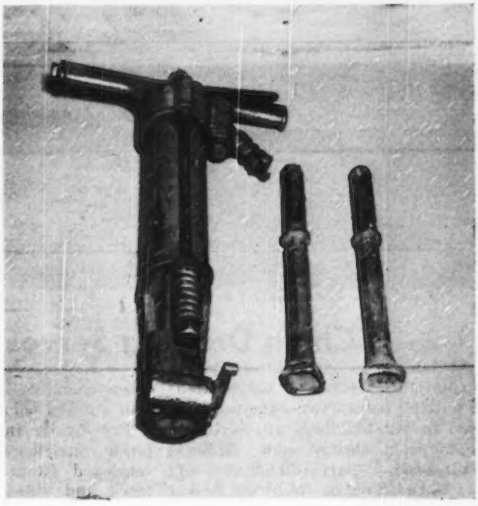
Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds), ton:	
Crude No. 1	$960@$1,050
Crude No. 2	$492@$550
Spinning fibers	$333@$475
Shingle fibers	$95.50@$141
Paper stock	$78.50@$88
Waste	$58
Shorts	$37@$52
Vermont, f.o.b. Hyde Park:	
Shingle stock	$97.00@$107.00
Paper stock	$68.50@$85.00
Waste	$55.00
Shorts	$25.50@$46.50
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$11.50@$12.00
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$9.00@$9.50
Bauxite, long ton, f.o.b. point of shipment:	
Domestic, crude, 50 to 53 percent (not dried)	$4.00@$5.04
Domestic, chemical, 55 to 58 percent	(a)$8.50@$9.50
Domestic, abrasive, 80 to 84 percent	$18.00@$18.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, airfloated bulk	$8.50@$9.50
North Carolina ceramic grade	$18.00@$20.00
Feldspar, bulk ton:	
Potash or soda feldspar, 200 mesh	$18.50
Glass spar, white, 20 mesh	$11.75@$12.50
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois, 70% effective, CaF_2, ton	$37.00
Acid 97% concentrate, bulk, ton	$43.50
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$30.50
Mica—Domestic f.o.b. mines, Punch, 12 to 22c. per lb. according to size and quality. Sheet, clear, 1½ x 2 inch, 70 to 75c.; 2 x 2 inch, $1.10 to $1.20; 2 x 3 inch, $1.40@$1.50; 3 x 3 inch, $1.70@$1.80; 3 x 4 inch, $2.10; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet ground, very fine, $120 @ $130 per ton. Bulk sales, dry ground, $32.50@$60.00 per ton. Scrap, $30 and up.	
Ocher, Georgia, ton, in sacks	$24.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a)12@14c.
Sulphur, Texas, mines, long ton	$18.00
Talc, f.o.b. works, ton:	
New York, purified	$18.50@$20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50

(a) Nominal

IRON AND STEEL

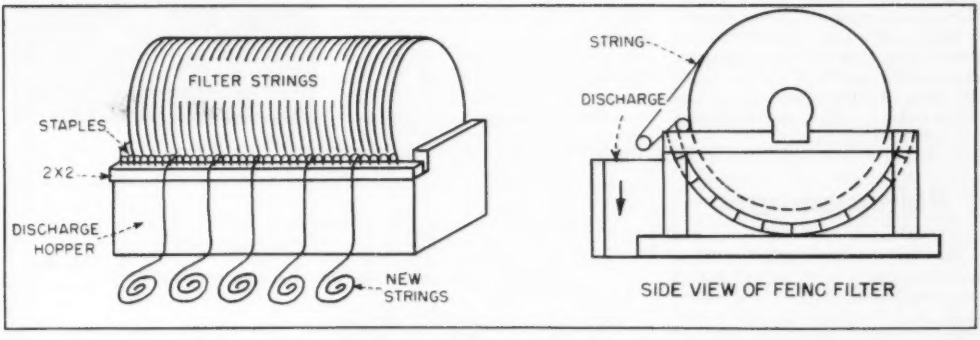
Pig iron, gross ton, basic, Valley furnaces	$46.00
Steel, f.o.b., Pittsburgh billets, net ton	$52.00
Structural shapes, 100 lb.	$3.40

OPERATING IDEAS



Pneumatic Spike Driver

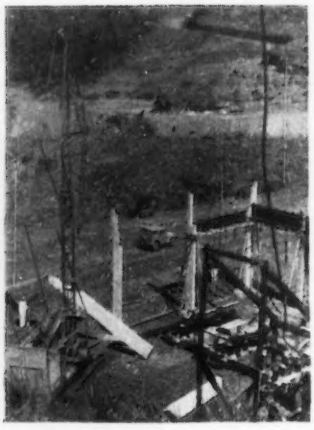
Workmen at the U. S. Naval Base, Portsmouth, N. H., found that they could drive rail spikes effectively with the air-operated paving breaker shown above. A short length of hexagonal steel forged with a shallow socket at one end as illustrated served to drive the spikes into the ties. Photographs through courtesy of Portsmouth Naval Base and the Armed Forces Trade Magazine Newsletter.



A Quick Way to Replace Filter Strings

Douglas Laird, solution operator at Central Patricia Gold Mines, Ltd., Central Patricia, Ontario, reports that he could replace strings on the Feinc string filter more rapidly by employing the method sketched here. He mounted a 2x2 strip on the splash guard of the discharge box as shown and drove as many staples into the strip as possible without splitting it. Then new strings were threaded through the staples and onto the filter. The filter was started up until the new strings just started around, after which they were put into the guide roller.

Mr. Laird concludes, "I find that I can cover the filter from one end to the other in one operation, and use as many as 20 strings without any help."



Churn Drill Rig Serves as Construction Crane

Churn drill rigs are not limited to putting holes down—they can be used to put buildings up, as these photographs clearly show. Gilbert Whitehead, superintendent of mines, Cia. Vale do Rio Doce, S. A., Itabira, Brazil, reports that a Bucyrus Erie 42-T churn drill rig proved very useful in constructing the mine machine shop and compressor house in the absence of a suitable crane.

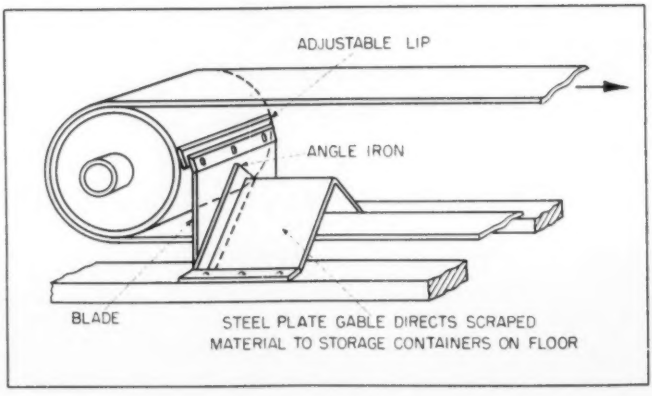
Nineteen roof trusses, 55 ft. long weighing 2½ tons each, were raised 50 ft. above the ground as shown with the rig. A wooden beam was bolted to the tower of the drill to facilitate raising the trusses and protect the operator. Time required to raise, set in place, and brace the trusses was about 12 min. Six men worked on a platform set on a 30-ton shop service crane to jockey the trusses in place and level and brace them, while the crane operator worked below.

Previously, in a similar warehouse construction job a contractor employed 10 men using a chain block and wooden tower to raise roof trusses. This work took six days per truss. So the saving in labor using the drill tower was considerable, actually 478.6 man-hours per truss.

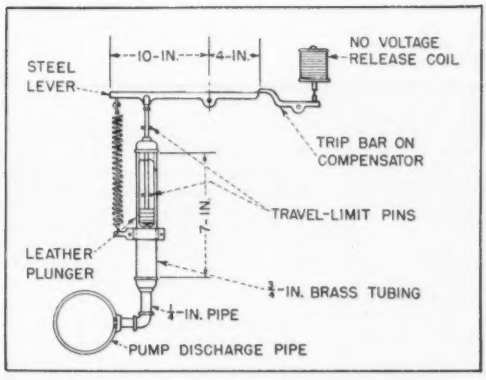
Later, an angle brace with a pulley was bolted to the tower of the drill. This unit was used to place 16 reinforced pre-cast concrete columns forming the main structure of the compressor house. These columns were roughly 28x9 in. by 22½ ft. They were bolted to the foundations and held together by beams poured at foundation level. Harold C. Varney, chief of the mechanical division of the mining department, dreamed up this idea.

Pulley Scraper

This belt conveyor pulley scraper was designed to prevent wet sticky ore from building up on the pulley face, thus stopping excessive belt wear and shutdowns. The scraper unit consists of an upright blade with an adjustable tempered steel lip and a steel plate gable to deflect scraped material into containers on the floor. The scraper blade is attached to the gable by means of a triangular flange made of angle iron. Wing nuts and bolts hold the scraper lip to the blade so that necessary adjustments can be made rapidly.

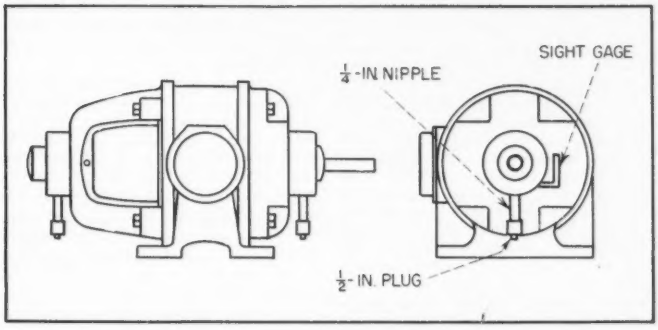


If Pump Fails—Motor Stops



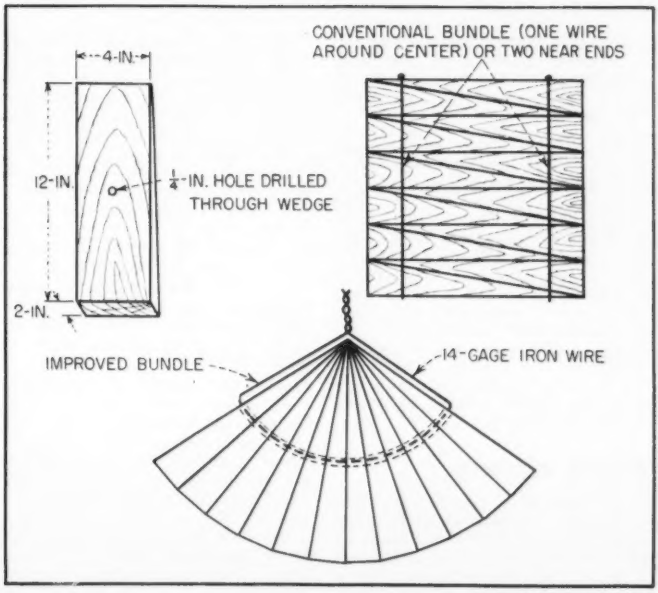
This inexpensive device automatically stops the motor when a centrifugal pump ceases to deliver water. It consists of a 10-in. steel lever which is pivoted slightly off center. One end of the lever is raised by a small plunger rod assembly connected to the discharge pipe of the centrifugal pump. The other end is connected with the trip bar of the compensator. Operation is simple. As long as water pressure in the discharge pipe is normal, the plunger rod holds the inner end of the lever up so that the trip bar is also held up. When the pressure falls, however, the plunger rod drops and allows the lever to fall. This operates the trip and stops the pump motor.

Trap for Motors



This dirt trap consisting of an ½x4-in. nipple fitted with a sleeve and plug was installed in mill motors of the Nancy Lee mill, Superior, Mont. Dick May, of Wallace, Idaho, who submits this sketch, says that "they save considerable bearing wear by allowing dirt and dust to settle out, and thus keep away from the path of the oil ring." These traps are useful on oil ring motors and those in which the ball bearings run in oil.

A Better Way to Wire Wedge Bundles



In many mines wedges are wired together in tight rectangular bundles with wedges stacked as shown here. When the timberman removes the first wedge underground, the bundle generally breaks apart and wedges fall all over the drift or stope floor. If wedges fall into the gob, they generally stay there.

This difficulty can be eliminated by using the method illustrated here which was submitted by E. R. Syms, mine superintendent of Central Eureka Mining Co., Sutter Creek, Calif.

A soft iron wire of No. 14 gage, about 2 ft. long, is used to string the wedges together through the ¼-in. holes drilled through the wedges. Twelve wedges form a bundle. They can be removed one at a time by untwisting the wire. A twist of the wire holds the remaining wedges together.

"This method prevents a lot of wedges from lying around the working places," writes Mr. Syms in summing up the advantages of this method.

NEW BOOKS

HOW TO PLAN PENSIONS. A Guidebook for Business and Industry. By Carroll Boyce, Associate Editor of Factory Management and Maintenance. Published by McGraw-Hill Book Co., New York 18, N. Y. Pp. 479. Price, $5.

Now that pension plans are looming as a major issue in many labor negotiations, mining men will be interested to know that a timely book on this subject is available. This book was prepared to meet the urgent demand of industry for more knowledge about the pension problem which has mushroomed into national prominence so recently. The information included in the book is so up-to-date, in fact, that it includes these items in the appendix: Comparison of Ford, Bethlehem, and CIO plans; text of United Mine Workers' plan; text of Inland Steel "optional" plan; text of Ford plan; text of United Auto Workers' "Basic Minimum Standards for Supplementary Security Programs," excerpts from the Report of the President's Steel Industry Board.

In easily readable style this text tells you how much pensions cost, how to plan pensions, what pitfalls to avoid in negotiating pensions, what rights to insist upon, what the unions seek to gain, how to handle grievances and arbitration pertaining to pensions. Under the heading of "The Human Problem" Mr. Boyce explains how and what to tell your employees about pensions and how to prepare employees for retirement. Broader aspects of the pension problem are discussed in concluding chapters entitled Impact on Individual Companies; Impact on the Nation; and What's Ahead for Pensions.

SOUTH AFRICAN MINING & ENGINEERING YEAR BOOK FOR 1949 AND 1950. Incorporating the Rhodesian Mining Year Book. Published by the South African Mining Journal Syndicate, Ltd., 201 Jubilee House, Simmonds St., Johannesburg, Union of South Africa, and Argus South African Newspapers, Ltd., 85 Fleet St., London, E.C.4, Pp. 567. Price, 45s., post free.

This large 10x14-in. volume consists essentially of reports of annual or general meetings of all major South African and Rhodesian mining companies. These reports reveal such information as the financial position of companies, major development activities, activities of subsidiaries, exploration reports, mining costs, welfare projects, and major difficulties faced by operators during recent months. A directory section lists capitalization, directors, and offices of mining, industrial and financial companies in South Africa. Another section lists principal firms in the engineering, electrical, iron, steel, machinery, hardware and allied trades in the Union of South Africa, and Northern and Southern Rhodesia.

ENGINEERS' DICTIONARY—ENGLISH-SPANISH and SPANISH-ENGLISH. By Louis A. Robb, American Society of Civil Engineers. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Pp. 664. Price, $12.50.

Words included in this dictionary are those frequently used in the following branches of engineering: mining, metallurgy, mechanical, petroleum, marine, civil, electrical, chemical, and others. With such broad coverage as this, the text naturally does not contain a complete vocabulary of geological, geophysical, and mining terms. However many words used in the mineral industries are listed including such as these: blockholing, bornite, braunite, bulldozer, carboloy, cherry picker, drill chuck, drill jumbo, granodiorite, headframe, lagging, lifter, magnetometer, nipping, overburden, pilot raise, pugmill, resuing, stope, thorium, tugger hoist, underthrust fault, uranium, vug, weightometer, and zircon.

INDUSTRIAL MINERALS AND ROCKS. SECOND EDITION. Completely revised by the AIME Committee on Industrial Minerals, Samuel H. Dolbear, Chairman of the Editorial Board. Published by the American Institute of Mining & Metallurgical Engineers, 29 W. 39 St., New York, N. Y. Pp. 1,156. Price, $8.

The second edition of Industrial Minerals expands and brings up to date the material presented in the first edition published in 1937. The new edition maintains its position as a leading reference book on the subject. Fifty chapters covering specific commodities have been prepared by recognized specialists in their respective fields. Typical chapters include concise reviews of geology and occurrence, composition and properties, production and imports, preparation for markets, commercial uses and prices for specific minerals, or groups of similar minerals.

BOOKS RECEIVED

Principles of a New Energy Mechanics. By Dr. Jakob Mandelker, Assistant Professor of Mechanics, Georgia Institute of Technology. This text is for students of advanced concepts of physics. Published by Philosophical Library, 15 E. 40 St., New York 16, N. Y. Pp. 73. Price, $3.75.

Chromite Deposits of Boulder River Area, Sweetgrass County, Montana. Geological Survey Bulletin 948-C. By A. L. Howland, E. M. Garrels, and W. R. Jones. For sale by Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C. Pp. 24. Price, $1.25.

The following information circulars and reports of investigations may be obtained from the Bureau of Mines, Publications Distribution Section, 4800 Forbes St., Pittsburgh 13, Pa.

R.I. 4576. Investigation of the McGuffy Creek Chromite Deposit, Siskiyou County, Calif. By Frank J. Wiebelt. Pp. 3.

I.C. 7528. Review of Literature on Conditioning Air for Advancement of Health and Safety in Mines. Part III. Methods of controlling the chemical and physical qualities of underground air. By J. J. Forbes, Sara J. Davenport and Genevieve Morgis. Pp. 57.

I.C. 7524. Mining Methods and Costs at the Atlas No. 2 Zinc-Lead Mines, West Pinos Altos Mining District, Grant County, N. M. By Walter P. Storms. Pp. 11.

I.C. 7526. Conveyor Systems In Underground Iron-Ore Mines, Lake Superior District. By Eugene Binyon. Pp. 33.

R.I. 4562. Lead Smelting in the Open Hearth. Part 1. Problems Involved in Smelting Rich Charges. By G. L. Oldright. Pp. 18.

R.I. 4527. Recovery of Aluminum from Submarginal Bauxites. Part 1. Electric Furnace Production of Calcium Aluminate and Ferro-Alloy. By Charles E. McCarthy, Richard Cole, Earl Nichols, Hewitt Wilson, and John Robert. Pp. 93.

R.I. 4528. Recovery of Alumina from Submarginal Bauxites. Part 2. Extraction of Alumina from Electric-Furnace Slags of Calcium Aluminate. By Maurice Thompson, Henry McLeod, Jr., and Milford Skow. Pp. 91.

R.I. 4545. Concentration of Oxide Manganese Ores from the Tintic District, Eureka, Juab County, Utah. By A. O. Ipsen, H. D. Snedden, and H. L. Gibbs. Pp. 18.

R.I. 4574. Flotation of Silver Chloride from an Oxide Ore. By A. L. Engel and T. A. Jackson. Pp. 5.

R.I. 4572. Diamond Drill and Auger Sampling of Vanadiferous Shale Mercur Dome Mine, Tooele County, Utah. By William King and Stephen Wilson. Pp. 8.

R.I. 4575. Investigation of the K.T. Dome Zinc-Lead Mine, Owen and Henry Counties, Ky. By William A. Beck. Pp. 9.

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E&MJ Report

Yugoslavia's Minerals—Stake in a Long-Term Gamble

In March, Jack Christie got back to Frankfurt from a long trip through Yugoslavia's mining districts. He went there at E&MJ's request to find out what Marshall Tito was doing with his country's mining potential, and what he hoped to do. This is a preliminary report on that visit. A detailed account of the present status of mining in Yugoslavia begins next month.

JOHN J. CHRISTIE

McGraw-Hill World News, Frankfurt, Germany

THE TITO REGIME is going all out in its emphasis on mining. It has survey parties out after new deposits of coal, iron ore, and non-ferrous metals in all parts of the country.

Prospecting is of a preliminary nature due to lack of deep drilling equipment. But, it serves to point up the tremendous mining potential of this country, which, for example, is said to contain 16 of the 23 metals and minerals listed as strategic by the USA.

Exploitation of these vast reserves is a long-term propostion. Virtually all equipment has to be imported. It has come from Western countries exclusively, now that Tito is isolated economically from the Eastern bloc.

Although it may take many years before Yugoslavia realizes its full potential in terms of output, development of mines is certain to be in the forefront of the Tito regime's economic program for two reasons: 1. Mining is a big feature of the Five Year Plan anyhow. 2. It is one of the three industries most favored by the West for financial assistance.

Attitude of the West toward Tito, as expressed in current U.S. policy, is this: The U.S. and Britain want to strengthen Tito's economy as a matter of practical politics. They want to encourage his defiance of Soviet imperialism. But, by no means, do they consider his country a suitable applicant for venture capital for over-all industrialization. His business address alone, i.e., his location under the "Iron Curtain", makes him a precarious risk. His credit standing is weakened further by his ideology and what Western observers term a far too ambitious Five Year Plan.

Western credit policy, therefore, is concerned chiefly with assisting those industries with best export volume potential. These include mining, forestry, and agriculture, all of which have good markets in the West. The idea is to give Tito a sound basis for expanding trade with the West. He can go on from there alone toward his goal of industrialization and a higher standard of living for his people.

Trepca lead-zinc and Bor copper mines, developed prewar by British and French capital, respectively, have top priority in the non-ferrous mining program. They are the country's most advanced mining developments and are already top foreign exchange earners. Half of the $12 million earmarked for non-ferrous mining out of the recent Export-Import Bank loan is for these mines.

Out of the other $6 million, the smaller lead-zinc mines at Mezhica and Zletove are getting more equipment. But, most of this sum will be spent on developing and mechanizing chrome, antimony and bauxite mines. These include: the chrome mine at Radusha and a new one at Deva; antimony mines at Zayacha, Lisa, and Buyanovac; and bauxite (52% to 56% aluminum oxide) mines at Drnish, Mostar, and Roviny.

Non-ferrous mining also is due to receive a portion of the World Bank loan of $25 million recently granted the Tito regime, although specific projects aren't yet finalized.

Mining figures prominently in the recent British-Yugoslav trade agreement, the first important one to be made with a Western power since the bolt from the Kremlin. This agreement envisions an exchange of over £20 million worth of goods both ways over a period of five years. It provides Tito a medium term credit of £8 million for capital goods and £5 million revolving credit, making Yugoslavia's credit reserves good for an estimated £20 million over the life of the pact.

British committments under this agreement relating to the mining industry include: machinery valued at £200,000 to establish cable manufacturing; installations for a new manganese plant; lead, zinc, copper, pyrites and gold flotation equipment and miscellaneous mining equipment.

Timber and non-ferrous metals will be Yugoslavia's chief exports to Britain.

Discovery of tremendous bauxite reserves are reported from southwest Montenegro, and a 70-sq. km. area of white bauxite around Miksic is said to contain large deposits of montmorillonite. Discovery of vanadium and titanium is reported in connection with surveys of bauxite deposits in Dalmatia, in the Like area, and in Hercegovina.

Further searches for manganese are reported going on in Kicevo, Gostivar and Uzice areas. Prospecting for nickel is reported underway at Stragari, Gokcanica and Ba.

The government recognizes that intensive exploitation of new reserves depends upon getting equipment for mechanization. Meantime, according to the Ministry of Mines' 1949 year-end report, it is the government's policy to work as many small mines as manpower resources will permit.

Major effort is going into exploration and exploitation of the country's vast low-grade coal reserves and its iron ore deposits. Also, the Ministry of Mines reports that during 1949 Yugoslavia began to exploit her estimated 100 million tons of oil shale.

Metals, however, will continue to be the leading Yugoslav export to the U.S. in the forseeable future. Other items are specialities like hops, medicinal herbs, luxury foodstuffs, etc. Total Yugoslav exports to the U.S. in 1949 were valued at $17,612,471, of which $14,037,922 represented non-ferrous metal shipments.

These shipments, in dollar value, included: lead, $7,033,222; blister copper, $4,797,371; silver $863,985; bismuth, $447,127; chrome, $408,724; antimony, $304,553; and mercury, $182,940.

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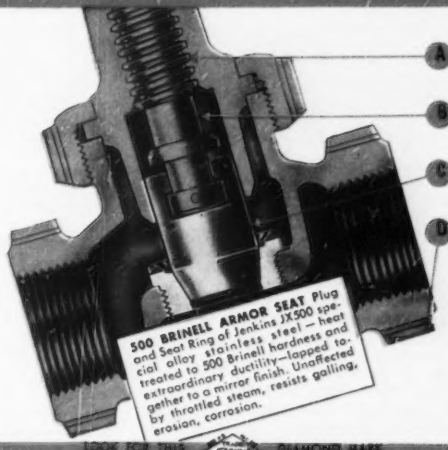
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PERSONAL NEWS

AWARDS PRESENTED by Dr. Lewis E. Young (extreme left), retiring president, American Institute of Mining & Metallurgical Engineers at the annual meeting held in New York, Feb. 12-16, went to William E. Wrather (second from left), director of geology, U. S. Geological Survey, for achievement and leadership in petroleum geology; Arthur F. Taggart (second from right), professor of mineral engineering at Columbia University, for outstanding contributions to progress of mineral beneficiation; and Walter R. Hibbard, Jr. (right), assistant professor of metallurgy at Yale University, for his paper on "Plastic Deformation for Large-Grained Copper Specimens."

Joel B. Pomerene, geologist, and **James G. Phillips**, mining engineer, of Ishpeming, Mich., and **Blair T. Burwell**, mining engineer, of Crosby, Minn., are at Steep Rock Lake, Ontario, supervising Inland Steel Co.'s drilling program at its recently acquired option from Steep Rock Iron Mines, Ltd.

Eric G. Orling has been appointed manager, pigment sales, for the Cleveland branch, National Lead Co. **Carlton H. Rose** has joined the staff of the National Lead Co. office in Washington, D. C.

Miles P. Romney, for the past 14 years, field engineer with U. S. Smelting, Refining & Mining Co., resigned Mar. 11 to act as manager for an operation in Cassia County, Idaho, for the R. C. Duvall Corp. This company was formed recently to operate a relatively newly developed gold orebody. Mr. Romney will continue to make his home in Salt Lake City at present.

Thomas E. Lloyd, machinery editor of *Iron Age* since 1948, has been appointed manager of publications of the American Institute of Mining & Metallurgical Engineers, to succeed **T. W. Lippert**, resigned. Mr. Lloyd has held various editorial positions with *Iron Age* in Detroit, Cleveland and Pittsburgh.

Curtis W. McGraw, vice-president and treasurer of the McGraw-Hill Publishing Co. since 1944, was elected president and chairman of the board on Feb. 24. He succeeds his brother, **James H. McGraw, Jr.**, who is retiring to be relieved of the burden of executive management. Mr. McGraw, Jr., has headed the company for the past 20 years, since the retirement of his father, founder. Curtis McGraw joined the organization in 1920 on the staff of the McGraw-Hill Book Co. **Willard Chevalier**, associated with the company since 1922 in various editorial and publishing capacities, was appointed executive vice president. **Joseph A. Gerardi**, vice president and secretary, was elected treasurer of the company to succeed Curtis W. McGraw.

Leroy D. Petterson, San Bernardino, Calif., has been elected president of the Western Mining Council, succeeding **Fred B. Greusel**. Also elected to office were **Prof. W. L. Kern**, vice president; **J. E. Shotwell**, second vice president; **L. Powers**, third vice president, and **A. Cunningham**, recording secretary.

Arthur E. Glover, who has been acting assayer in Fairbanks, Alaska, for the Territorial Bureau of Mines, will replace **Nil Johannson**, Government assayer in Ketchikan, who recently retired.

Frank G. Breyer, member of the consulting metallurgical and chemical engineering firm, Singmaster & Breyer, of New York, was made an honorary member of the American Institute of Chemists. The presentation, made in honor of Mr. Breyer's important applications of chemistry and engineering in industry, took place at a meeting of the Institute's New York chapter, held Feb. 15. His outstanding contributions have been in non-ferrous metallurgy.

Leon Battles has been appointed chief engineer of the Canisteo district of Oliver Iron Mining Co. on the Mesabi range to succeed the late **R. P. Weidenfeller**, who died Jan. 28.

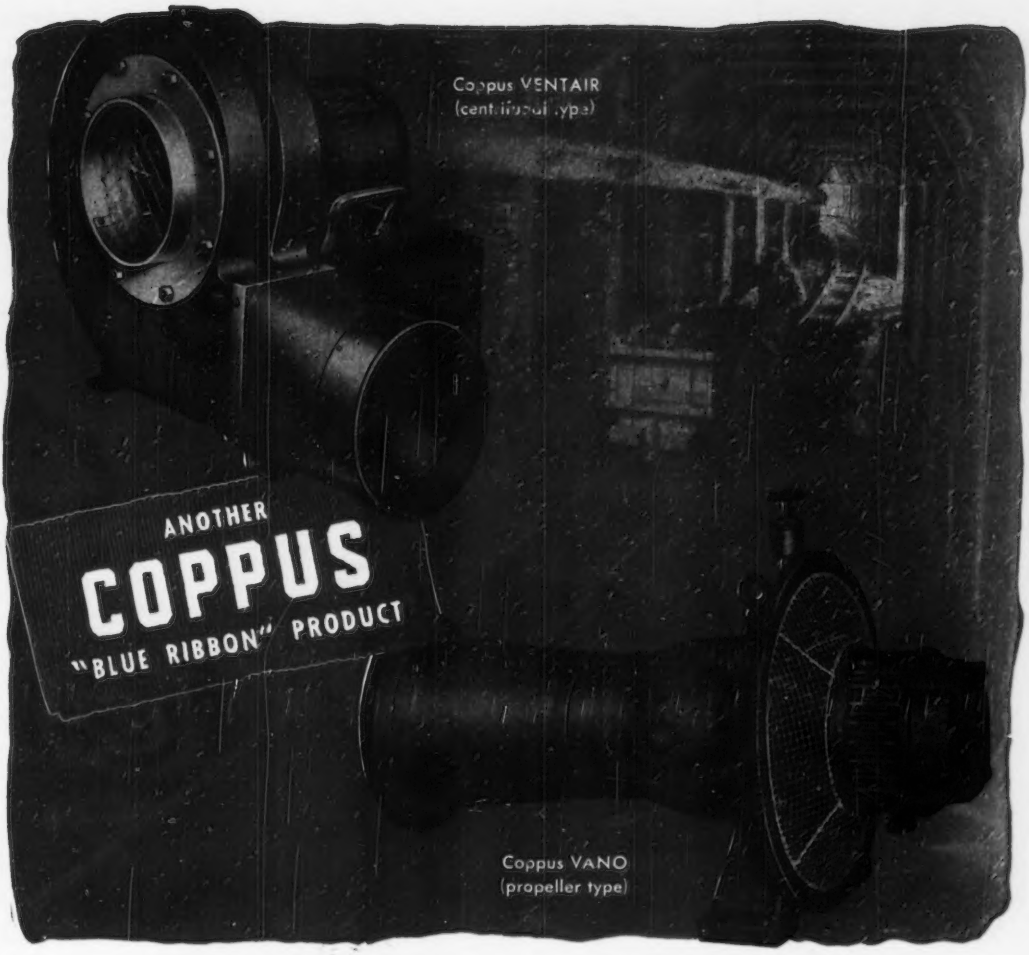
Robert L. Johnson, mining engineer, has been made assistant mining captain at Oliver Iron Mining Co.'s Fraser underground mine. The promotion was announced by **J. H. Hearding, Jr.**, general superintendent of the Hibbing-Chisholm district.

Wayne Bolitho, assistant chief engineer at the Inter-State Iron Co.'s mine, has been transferred to Benson Iron Mines at Star Lake, N. Y., operated by the Jones & Laughlin Ore Co.

HOWLAND BANCROFT, who returned to New York recently, after spending seven months in South Africa, has been elected to the board of directors of the Cerro de Pasco Copper Corp., and has been appointed a consultant to the same corporation.

Frederick F. Kett has retired after 20 years' association with Vanadium Corporation of America. For the past 12 years he has served as general manager of the mining division. He will continue as mining consultant to that company with his temporary address at 75 Crecienta Drive, Sausalito, Calif.

V. A. Lowinger, former chairman of the International Tin Research & Development Council, retired recently. He was succeeded by **G. F. A. Burgess**,



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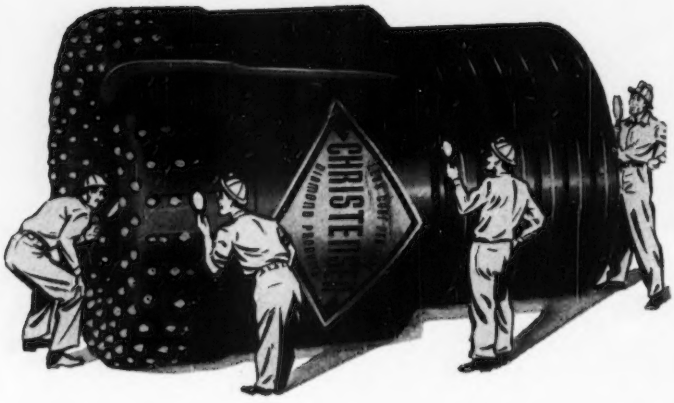

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Joseph H. Reid, manager of the Titanium Division of National Lead Co., has been elected a director and member of the company's executive committee. He succeeds **Claude F. Garesche.** Mr. Reid joined the company in 1927 with the St. Louis Smelting and Refining Division as a mining engineer. He later became production manager of the Baroid Sales Division, and in 1947 was made assistant manager of the Titanium Division, becoming manager two years later.

Thomas W. Lippert, manager of all publications for the American Institute of Mining & Metallurgical Engineers, and editor of the *Journal of Metals,* has been appointed general manager of Titanium Metals Corporation of America. The announcement was made by **H. C. Wildner,** president of the new enterprise, jointly owned by National Lead Co. and Allegheny Ludlum Steel Corp. Mr. Lippert, a graduate of Carnegie Institute of Technology, was for many years editor of *Iron Age* and a director of the Chilton Co.

WILLIAM M. HAYDEN, manager of industrial research for Anaconda Copper Mining Co., resigned Mar. 1, to become president of Chemetals Corp. Mr. Hayden has been with Anaconda and its smelting and fabricating subsidiaries since 1927. He has worked directly with Cornelius F. Kelley, chairman of the board, on various aspects of world minerals and their impact on our domestic economy through the war and postwar years. The new corporation will occupy offices at 488 Madison Ave., New York.

M. H. Kuryla, president of U. S. Smelting, Refining & Mining Co., retired March 1. He was succeeded by **F. S. Mulock,** formerly vice president and general manager of western operations. **George Mixter,** vice president, was appointed executive vice president, effective Mar. 1.

The Marquette Range Engineers Club, Ishpeming, Mich., elected the following officers for 1950: **A. J. Guscatt,** president; **P. P. Ribotto,** vice president; **H. R. Anderson,** treasurer; **G. T. Hollett,** secretary; and **R. W.**

Braund, J. S. Westwater, and S. Thorvaldson, directors.

Gene Nicolai, of Coulee Dam, assistant district information officer for the Columbia Basin Project for the past five years, has been made regional information officer for the Bureau of Mines & Rocky Mountain Region, with headquarters in Denver, Colo. Before joining the Columbia Basin Project, Mr. Nicolai served on the staff of **Allan Sherman,** chief of the Office of Minerals Reports, in Washington, D. C.

STUDENTS NAMED to receive $500 scholarships offered by American Smelting & Refining Co. for 1949-50 at the Colorado School of Mines were Leo Borasio (seated, at left), of New York City, and Lawrence R. Wolff (seated, at right), of Chicago. John G. Smith (standing), of St. Albans, Vt., senior in mining engineering, was selected for the Kennecott Copper Corp.'s $750 scholarship, on the basis of scholastic record and promise in the mining engineering field. Two other students, not pictured, who also received AS&R scholarships were Louis L. Landers, Longmont, Colo., and Roger R. Nelson, Golden, Colo.

Charles N. Bailey has been appointed chief engineer for Oliver Iron Mining Co. Before joining the company last September, Mr. Bailey was assistant chief engineer of International Minerals & Chemical Corp., one of the world's largest phosphate producers. Mr. Bailey succeeds **Ford E. Boyd,** who has retired after 40 years of continuous service with the Oliver company.

Parke A. Hodges was recently elected vice president of Behre Dolbear & Co., consulting mining engineers and geologists, of New York. Before becoming a member of the firm, he spent 11 years in Chile and Mexico. In 1938 he returned to this country and for 10 years was mining and chief field engineer for Climax Molybdenum Co. Mr. Hodges recently completed a study of the chrome and vanadium

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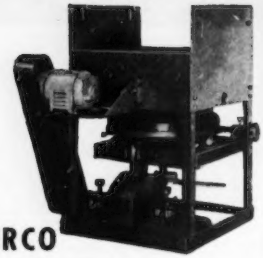

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THREE FIFTY-YEAR MEMBERS of the American Institute of Mining & Metallurgical Engineers are shown at the 79th annual banquet in New York, Feb. 15, with incoming president for 1950, Donald H. McLaughlin, president, Homestake Mining Co. They are (left to right): Walter Hovey Hill, of Grangeville, Idaho; Dr. McLaughlin; Leonidas D. Glenn, Nashville, Tenn., and Howard N. Eavenson, of Pittsburgh, Pa.

deposits of Southern and Northern Rhodesia and a geologic reconnaissance of the mineral possibilities of Southern Rhodesia.

J. O. Dolphin has been re-elected president of the Chamber of Mines of Eastern British Columbia. Vice presidents are **W. B. Montgomery** and **N. R. Sardich. Frank Pennoyer** continues as secretary-treasurer.

George O. Argall, Jr., of Denver, Colo., has been named editor of *Mining World*. He succeeds **John Dorsh**, who resigned recently to join the U. S. Bureau of Mines.

EARL A. TANNER, director of Inland Steel Co., and president and director of Inland Steel Products Co., of Milwaukee, and the Inland Steel Container Co., of Chicago, retired in March, after 30 years' service with the companies. Edward L. Ryerson, chairman of the board of Inland Steel Co., made the announcement.

Donald P. Knowles, mine superintendent of American Zinc, Lead & Smelting Co.'s operations at the Grandview mine at Metaline Falls, Wash., has gone to Hershey, Pa., to become assistant manager of the Annaville Stone Co. **John W. Currie**, of Portland, Ore., succeeds him.

Oglebay, Norton & Co., of Cleveland, has announced several executive changes in some of its associated companies. The directors of Columbia Transportation Co., owner of eight bulk, five crane and four self-unloading vessels, elected **R. C. Norton** as president; **E. H. Dorenbusch** and **F. R. White, Jr.**, vice presidents, and **Courtney Burton**, treasurer. **A. C. Bishop** was re-elected secretary and **R. H. Weir**, assistant secretary-treasurer. **H. S. Taylor** was elected president and director of the Toledo, Lorain & Fairport Dock Co. and **Courtney Burton** was elected treasurer. The Dock company operates the Baltimore & Ohio ore and coal facilities at Lorain, Ohio, and the Baltimore & Ohio coal dumper at Fairport, Ohio.

Charles F. Herbert, a partner in the Wade Creek Dredging Co. and Yukon Placer Mining Co., has been elected president of the Alaska Miners' Association in a meeting held at Seattle, Wash. A graduate of the University of Alaska, he was supervising engineer of the RFC from 1937 to 1940. Vice presidents are **R. E. Wyer**, of the Cleary Hill mines; **Fred K. Dent**, Council Dredging Co.; **John Miscovich**, of Fairbanks; **Harold Strandberg**, of Strandberg & Sons, and **J. A. Williams**, Alaska-Juneau Gold Mining Co. **Al Anderson**, of the Goodnews Bay Mining Co., was reappointed executive secretary.

Sidney Rolle, assistant manager of the Scomet Engineering Co., will leave April 13 for England and Europe, where he will visit metallurgical plants interested in large capacity induction furnaces for melting non-ferrous metals.

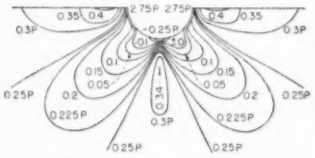
K. Peters, technical consultant to the Kingdom of Saudi Arabia, has recently returned to his headquarters in Jedda, S. A., after a visit to Japan and the United States on business for the Saudi Government. While in Japan, Mr. Peters made a survey of the industrial and mining centers of that country.

KELLOGG KREBS, formerly with American Cyanamid Co., has moved from Southern California to San Francisco where he has opened a consulting office in mineral dressing. After graduation from the University of California, in 1923, he gained early experience in metallurgy in Chile with the Braden Copper Co.

D. Fred Wallace, formerly an architect in Kansas City, Mo., has moved to Albuquerque, New Mex., and will engage in pumice mining operations in association with **Roy L. Cook**, of Albuquerque.

M. L. Sethi, formerly minerals adviser to the former Jaipur State, India, has joined the newly-formed province of Rajasthan as director of mines and geology.

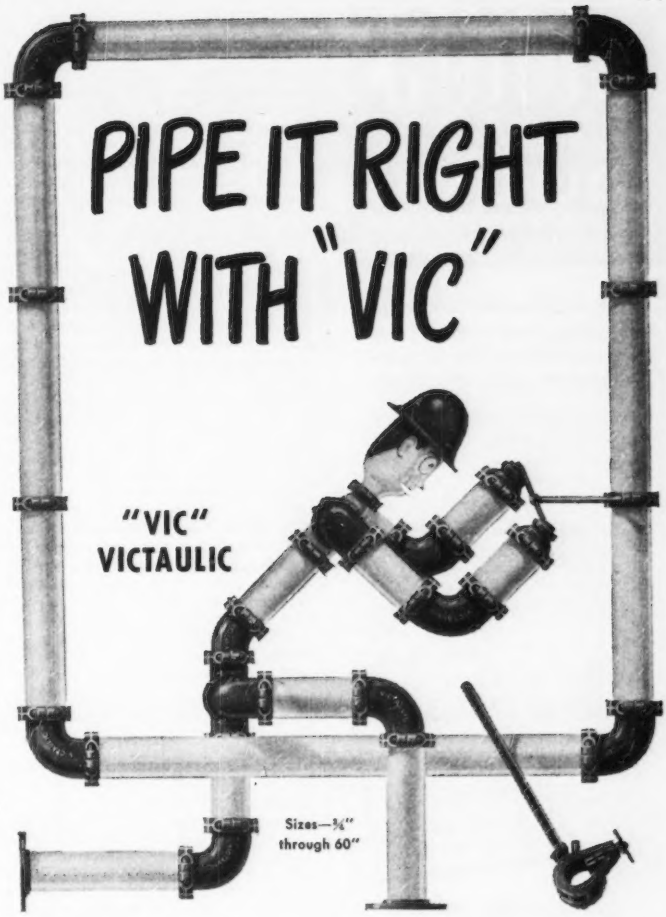
LETTERS



Professor McKinstry Comments . . .

To the Editor:

In an article, "Sedimentary Strata Experience Can Aid in Rock-Burst Study" (E&MJ, June, 1949, pp. 61-64), Mr. Rudolph W. Wuerker describes the collapse of a roadway in sedimentary strata. Although his illustrations and discussion are exceptionally interesting, it is difficult to recognize a consistent relationship between the mode of failure of the rocks and the stress diagram that is



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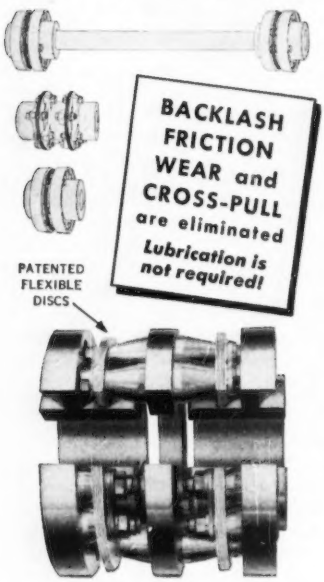

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offered by way of interpretation.

The illustration shows a "roadway" ("drift" to the hardrock miner) which has been driven at unspecified depth in horizontally bedded shale. As a result of rock pressure, the roof of the drift has been bowed downward and the floor arched upward, while steeply dipping cracks have developed in the sidewalls. Fig. 4 of the article, submitted in explanation of the mode of failure, is one of those diagrams used in photo-elastic studies to show the distribution of stress around a circular discontinuity. In this particular diagram the tangential stress at the sides of the circular hole is compressive and has a value 1.25 P, while stress at the bottom (and by symmetry also at the top) of the hole is tensile and has the value .25 P.

Now it is quite understandable that the vertical cracks in the sidewalls of the opening are extension cracks resulting from vertical compression. In fact they look so much like ordinary "tension cracks" that the author's conclusion that the "strata have . . . gone through complete rearrangement of the rock-forming components and the clayey binder" seems quite gratuitous, at least in the absence of more petrographic evidence than is presented in the article.

Although the vertical cracks in the sidewalls seem to present no serious problems of interpretation, it is difficult to believe that the down-buckling of the roof and especially the up-buckling of the floor have been caused by horizontal tension, for structures like this (particularly the bending of a horizontal steel girder) shout horizontal compression.

One may suggest that the difficulty stems from an arbitrary choice of stress diagrams. Though not so-stated in the article, the particular diagram selected depicts a special condition in which the stress that is assumed to have existed before the opening was made has a vertical component, P, and a horizontal component amounting to ¼ P. Such a state of environmental stress has been postulated in certain studies of rock bursts, presumably on the assumption that the column of rock has been loaded vertically while lateral constraint has prevented it from expanding horizontally. Under these special conditions, and taking Poisson's ratio as .25, the horizontal component of stress will indeed be ¼ P. But since few rocks have had just this history, there is no compelling geological reason for assuming that this was the state of initial stress. In fact, most rocks have been consolidated (by cementation or otherwise) while buried at depths where conditions probably approached hydrostatic stress. Through subsequently unloading by erosion, vertical pressure has been partially relieved, whereas the horizontal component of stress has had no opportunity for relief, so it is to be expected that at present mining depth the horizontal component will equal or even exceed the vertical component. Given such a state of environmental stress, the circular hole will experience, at its periphery, tangential stress that is compressive not only at the sides but also at the top and bottom. (This is true unless the lateral pressure is more than three times the vertical, in which case the sides, not the bottom, will be under tensile stress.)

If a diagram representing such a condition were used instead of Fig. 4, it would explain the actual mode of rock failure—at least insofar as an analogy holds between a round hole in homogenous material and a squarish hole in stratified rock. According to this interpretation, local compressive stress acting parallel to the sidewalls caused failure along extension cracks while compressive stress acting parallel to the roof and floor caused separation along bedding planes, accompanied by bulging of the strata into the opening.

Quite apart from this matter, one statement in the article arouses my curiosity. "Usually an anticline has less stress, whereas an increase can be noticed in the center and flanks of synclines." As this concept is unfamiliar to most structural geologists, it would be interesting to have references of further data regarding the observations and measurements on which this generalization is based; in particular: Is the stress that "can be noticed" compressional or tensional and how is it oriented?

H. E. McKinstry

Cambridge, Mass.

OBITUARIES

John B. DeMille, consulting engineer of Montreal, Que., Canada, and consultant for the Economic Cooperation Administration in Italy for the past two months, died suddenly of a heart attack, March 16, in Rome. He was studying Italy's mineral resources.

William Arthur Wasley, 64, died Feb. 7 in Cananea, Son., Mexico. He had been superintendent of the Cananea Consolidated Copper Co. since 1944. A native of Platteville, Colo., he was a graduate of the Colorado School of Mines, and worked for Utah Copper Co., Miami Copper Co., and Lucky Tiger Mining Co. before joining Cananea.

Dr. Victor Blanc, pioneer metallurgical chemist of Denver, Colo., died Feb. 5, following a short illness. He was 83. Born in 1867 at Versailles, France, he studied at the Sorbonne University in Paris and taught at the University of Paris and University of Milan. In 1892 he moved to Denver and opened a commercial laboratory, after becoming interested in the metallurgical aspects of chemistry and in the study of rare minerals.

Lucian W. Smith, 66, active in mining in Leadville, Colorado, New Mex-

ico and California, died in Oakland, Calif., Feb. 12. He is survived by his wife, three sons and a daughter.

Dr. Horace W. Gillett, 66, former director of Battelle Institute, died Mar. 3, near Nicholasville, Ky. He was internationally known as an authority on metallurgy and was responsible for the technical organization of Battelle Institute, serving as its first director from 1929 to 1934. After graduation from Cornell, he remained there to teach while working for his docorate degree. During summer vacations, he worked as a chemist with Thomas A. Edison. He later became associated with the U. S. Bureau of Mines, and in 1924 was made chief of the Division of Metallurgy, U. S. Bureau of Standards. In 1929 he became editorial director of *Metals and Alloys* magazine, now known as *Materials and Methods.* Following his resignation as director of Battelle in 1934, Dr. Gillett acted as chief technical advisor until his retirement in 1949, when he became technical consultant.

Charles W. Davis, 59, died Feb. 21 in Boulder City, Nev. Since April, 1945, he had served as chief of the Boulder City branch of the Metallurgical Division of the U. S. Bureau of Mines. Prior to that time, he had served the Bureau in various other capacities since 1916.

Laurence Canty, 75, veteran British Columbia prospector and gold miner who helped in the development of Hedley Mascot mine, died at Vancouver, B. C., Feb. 15.

Tasker L. Oddie, 79, former governor and U. S. Senator from Nevada, died Feb. 17 at his home in San Francisco. A native of Brooklyn, N. Y., he went to Nevada in 1898 after graduation from New York University, and two years later became district attorney of Nye County. He was associated with **Jim Butler** in the discovery that developed into the famous Tonopah gold field.

Charles H. Spinks, 77, retired mining engineer, died in Los Altos, Calif., Feb. 8. A graduate of the University of California, he was at one time general manager and chief engineer for American Magnesite Co.

Correction:

Through error, it was reported in the Dec., 1949, issue of *E&MJ*, that **W. F. Dietrich** was a professor of mining engineering at Stanford University, and also with the U. S. Bureau of Mines. Mr. Dietrich, for the past six years, has been senior associate in the firm of Dietrich, Morse and Associates, consulting chemical, metallurgical and mining engineers, with headquarters in Sacramento, Calif. He has also been managing owner of Campo del Mar Pottery, Capitola, Calif., for the past four and one-half years.

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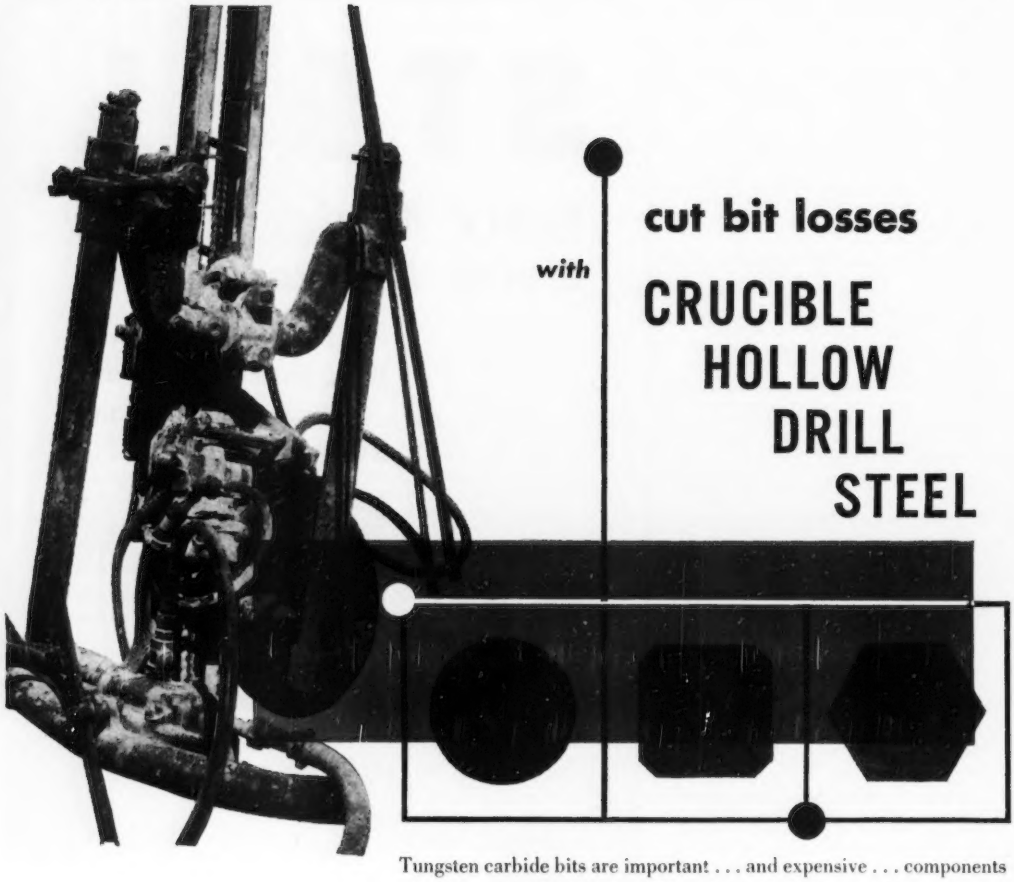

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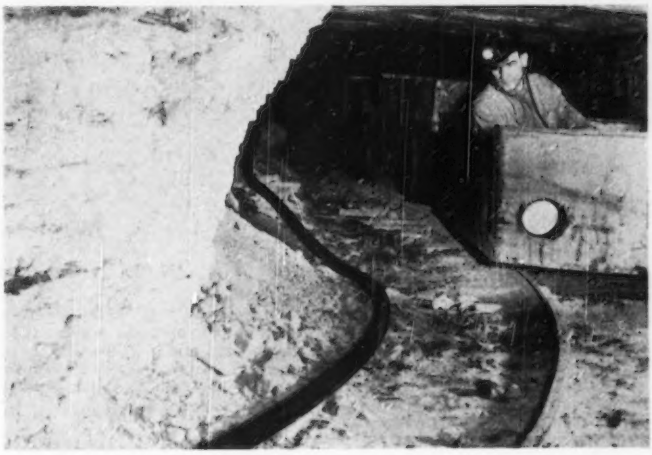

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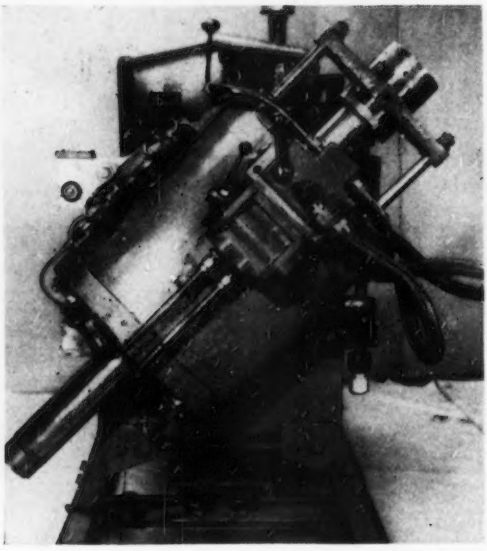

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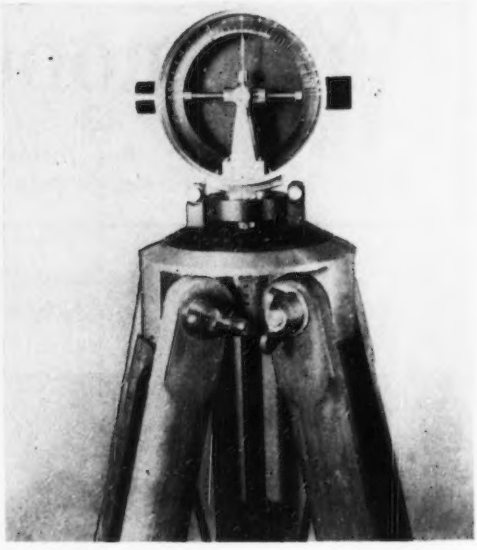
Hydraulic Diamond Drill & Products Co., Windsor, Ontario, Canada.



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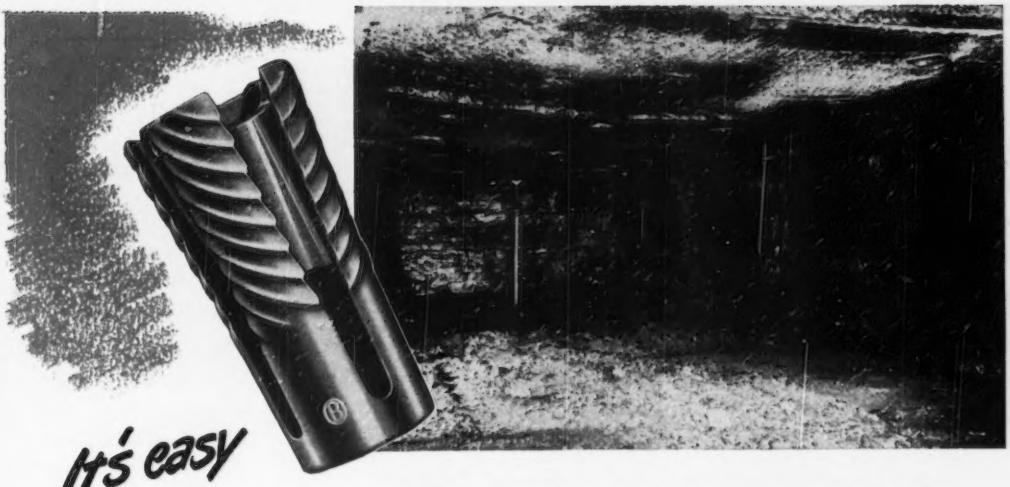
Available: **Geophysical Instrument Co., Arlington, Va.**

Geiger Counter Equipment Designed for Light Aircraft (4)

Now that the U. S. Geological Survey has officially reported that Geiger counters can be used in aircraft for uranium prospecting (See page 136), the following announcement will be of parallel interest. The Radiac Co., New York 17, N. Y., suppliers of portable radioactivity detectors, now offers the "Prospectometer," a Geiger counter designed for installation in light aircraft suitable for uranium prospecting. The unit, listed as Model 103, is a Geiger-Mueller count rate meter with an audible warning signal which is heard whenever the radiation intensity increases above a level chosen by the operator. The signal increases in frequency as the intensity continues to increase. It operates on 6, 12 or 24 volts.

The instrument has been supplied on a custom basis in the past, and installation was made at the Knoxville airport. Due to increased interest in it, brought about perhaps by its successful use in Colorado, Utah and Ontario, a standard model is being developed which will be suitable for practically all applications. Orders can be accepted for delivery in 90 days. Price is $750.

Radiac also announces the "Prospectoscope," Model 105-C, quoted at $325, which is specifically designed to make quantitative measurements of low-intensity fields of gamma radiation. Sensitivity of this model, which is reported to be 30 times as great as ordinary counters, is due to its large GM tube and moderately long time constant. Five ranges (1, 2, 5, 10 and 20) allow the Prospectoscope to measure wide variation of radiation intensity with easy readability. Normal background produces a deflection of two-thirds of full scale on the first range. Headphones are provided for use in planes and other noisy locations.



It's easy to use

O-B ROOF SUPPORT EXPANSION SHELLS AND PLUGS

CONVENIENCE

Proper pre-expansion is established at the factory when the shell is driven onto the plug. This also assembles the shell and plug into an easy-to-handle unit to be turned onto the bolt later at the mine.

SPEED

See how you can do a good job—swiftly! With a few turns of the wrist and a sharp rap on the bottom, the plug is on the bolt and the shell rests on its support (Palnut, upset ear, etc.) ready to go up into the hole. (Rapping the bolt head on the floor separates the shell from the plug. Then the shell prongs are free to spring in to conform with the hole diameter.)

● O-B Roof Support Expansion Shells and Plugs provide an easy way for rapid and secure roof bolting, because they're especially designed for the job. If you are bolting to keep your roof in tip-top shape, you'll want to know how O-B Roof Support Expansion Shells and Plugs measure up for convenience, speed and dependability.

DEPENDABILITY

Of course you want good roof! If you are using bolting to get it, remember this about O-B Expansion Shells and Plugs:

Properly installed in right-size holes, O-B Expansion Shells and Plugs will develop the full tensile strength of the bolt.

• • •

You can get more information on roof bolting. O-B field tests and observations, as well as clear illustrations of bolting procedure, are printed in our Bulletin No. 864-M. Use the coupon to get your copy.

4054-M(1)

OHIO BRASS COMPANY
Mansfield, Ohio
Please send me a copy of Bulletin No. 864-M.

NAME_____

TITLE_____

COMPANY_____

ADDRESS_____

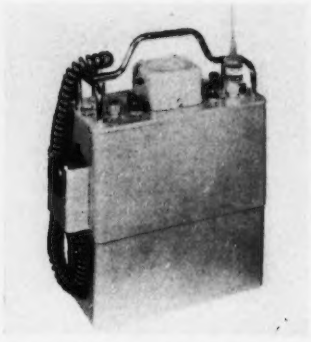
CITY_____ STATE_____

Ohio Brass

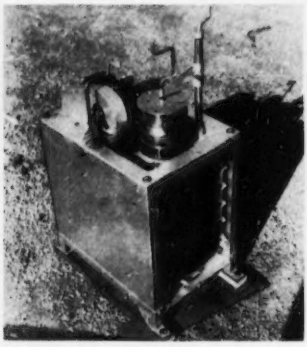
MANSFIELD OHIO, U. S. A.

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

MOBILE RADIO equipment for communication between widespread units is available for 20 kc. or 40 kc. channel widths. General Electric Co., Syracuse, N. Y. (5)

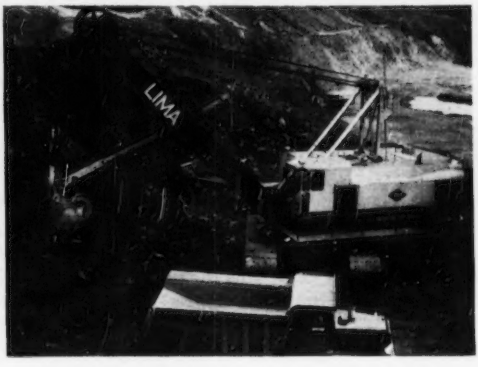


TWO-WAY PACK RADIO for closer supervision in open-pit operations has pack-to-pack range of 2 to 5 mi.; pack to mobile unit, 7 to 10 mi. Motorola, Inc., Chicago, Ill. (6)

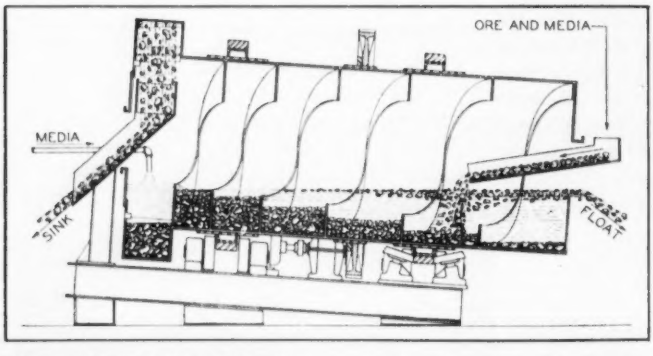


TESTING SCREEN gives fast, accurate sizing of your feed or product. Mechanically makes 2 to 7 separations. Pans are equal weight. Gilson Screen Co., Mercer, Pa. (7)

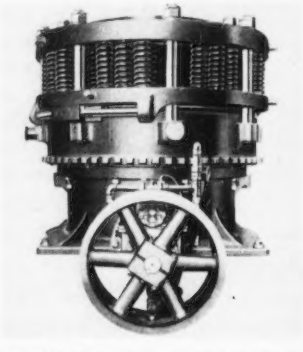
TWO-YD. SHOVEL is diesel or electric powered and is easily converted to clamshell, crane or dragline. Twin rope crowd is fully independent of hoist. Bucyrus-Erie Co., South Milwaukee, Wis. (8)



4 TO 6-YD. SHOVEL uses single diesel engine. Actual capacity depends on length of boom. As a dragline, it has capacities up to 7 yd. with boom lengths of 80 to 130 ft. Lima-Hamilton Corp., Lima, Ohio. (9)



HEAVY-MEDIA SEPARATOR is a slowly-revolving, inclined, cylindrical drum with spiral flights attached to the inner surface of the cylinder. Material to be separated and the heavy media are fed in at lower end. "Sink" is carried by spiral flights to high end. "Float" overflows a circular weir at the lower end. Hardinge Co., York, Pa. (10)



CRUSHER comes in 24, 36, 48-in. sizes. Improvements in Telsmith Gyrasphere give lower cost per ton, greater capacity, more uniform product. Smith Engineering Wks., Milwaukee. (11)

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their number on form below and mail.

HOISTS. Two catalogs (100-H-40 and 100-H55) cover general purpose hoists from 5 to 40-hp., and from 50 to 100 hp. Operating pictures as well as illustrations of mechanical parts and assemblies are used. American Hoist and Derrick Co., St. Paul, Minn. (71)

WOODEN BEARINGS. Manual treating with the principles and applications of "oil-less" wooden bearings in modern machine design has been published by Paramount Oilless Bearing Co., Worcester, Mass. (72)

WOOD PRESERVATIVE. This 15-page job deals with the theory and practice of preserving timber by applying "Osmosalts" by dip, brush or spray. Osmose Wood Preserving Co., Buffalo, N. Y. (76)

FLOTATION. Well illustrated and highly descriptive catalog on the Fagergren flotation machine has just been released by Western Machinery Co., San Francisco, Cal. (77)

ELECTROSTATIC PRECIPITATION. This 16-page well illustrated bulletin (GEA-5331) explains how electrostatic precipitation works, gives case histories of seven applications including smelters. General Electric Co., Schenectady, N. Y. (78)

V-BELTS, SHEAVES. Rockwood Mfg. Co., Indianapolis, Ind., has issued two bulletins filled with engineered data needed for selecting V-belts and sheaves. (79)

MAGNETOMETER SURVEYS. All services offered to the mining industry by Aero Service Corp., Philadelphia, Pa., including airborne magnetometer surveys, aerial photography, planimetric maps, exploration service, and plastic relief models are described and illustrated in their booklet, "You Can See More from the Air." (80)

How to Run a Lathe

Revised edition 49 of the lathe operators handbook, "How to Run A Lathe," is now available. Contains 128 pages and more than 350 illustrations on care and operation of metal-working lathes. Clearly written in non-technical language it is easy for the beginner to understand. Eleven chapters cover all phases of the work.

Order your copy from South Bend Lathe Works, South Bend 22, Ind. Paper bound edition is 25c. Imitation leather fabrikoid binding can be had for $1.00 per copy postpaid.

CYANIDATION. Ore dressing engineers should circle 81 on the card below to get this comprehensive booklet, "Chemistry of Cyanidation," put out by American Cyanamid Co., New York. (81)

DUST COLLECTOR. A 16-page booklet just published by Pratt-Daniel Corp., East Port Chester, Conn., provides detailed information on the new Vulcanet Type S dust collector and explains what the featured high narrow inlet slot does to increase collection efficiency in the range below 20 microns. (82)

SAFETY SWITCHES. HCI (High Capacity Interrupter) switches are described as having unusually high interrupting capacity, extremely high momentary current capacity and ability to handle short-circuits without damage, in a folder offered by Trumbull Electric Mfg. Co., Plainville, Conn. (83)

ELECTRIC PARTS. Brochure put out by Lincoln Electric Co., Cleveland, Ohio, announces the company's interesting factory parts exchange plan. A directory of 146 field service shops is included. (84)

CRUSHER. Bulletin from Allis-Chalmers, Milwaukee, Wis., deals with Hydrocone crushers which have been improved and extended to include 51-, 60- and 84-in. units. New design features are highlighted. (85)

COMPRESSIBILITY CHARTS. Bulletin (P-7682) from Worthington Pump and Machinery Corp., Harrison, N. J., contains compressibility charts and their application to problems involving pressure-volume-energy relation for real gases. (86)

WAGON DRILLS. This 10-page illustrated bulletin describes three models of wagon drills: UMW40 with a 4-in. cylinder bore; UMW35 with a 3½-in. bore; and UMW30 with a 3-in. bore. Worthington Pump and Machinery Corp., Holyoke, Mass. (87)

BEARINGS. Anti-Friction Bearing Distributors' Association, Cleveland, Ohio, has published a 20-page booklet, "Installation, Maintenance, Removal of Anti-friction Bearings." Gives a comprehensive treatment of bearing care. (88)

DIAMOND DRILLING. E. J. Longyear Co. has published a booklet, "Deflecting Diamond Drill Holes with the Improved Half-Row Deflecting Wedge." Containing 23 pages and 14 charts, the text gives precise instructions for deflecting drill holes. The subject is treated practically, based on field experience. (89)

CONTROL CENTERS. Standardized control centers for all the electrical equipment at your plant are described in detail in Westinghouse Electric Corp.'s booklet B-4216. Included are sections on how to plan a control center, dimensions and weights of equipment. (90)

USE THIS CONVENIENT CARD

to obtain further information on products and bulletins mentioned in the New Products Digest. Circle item numbers, tear out and mail.

April, 1950

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	8	15	31	38	45	71	78	85
2	9	16	32	39	46	72	79	86
3	10	17	33	40	47	73	80	87
4	11	18	34	41	48	74	81	88
5	12	19	35	42	49	75	82	89
6	13	20	36	43	50	76	83	90
7	14	21	37	44	51	77	84	91

My Name _____ Position _____

Company _____

Address _____

NEW PLANT for producing bulldozers, scrapers, wagons and rippers will be built on this 360-acre site near Joliet, Ill., by Caterpillar Tractor Co.

Memos from the Manufacturers

J. M. Donahue has been named manager of Mack-International Motor Truck Corp.'s Atlantic Div.

Precision Castings Co., Inc. has purchased controlling interest in Reed Metal Crafts, Inc. of Chicago.

Loggers & Contractors Machinery Co. will act as Oregon distributor for Lippmann Engineering Works.

Leaston J. Howell has been elected director of Acme-Hamilton Mfg. Co. and made vice president in charge of the company's two rubber plants in Trenton.

Pennsylvania Crusher Co. has announced four new sales representatives: Wharton L. Peters Machinery Co., St. Louis; Leatherman and Mertz, Detroit; Swaney Co., Newtonville, Mass.; Stanley B. Troyer, Crosby, Minn.

R. A. Trask has assumed managership of sales of John A. Roebling's Sons Co.'s Chicago corporation. G. C. Bukowsky succeeds Mr. Trask as head of the San Francisco office.

Jos. G. Broz is now sales manager of the Four Cycle Diesel Engine Dept. of Nordberg Manufacturing Co.

Henry B. Ahlers has been named assistant to the general manager of the Industrial Products Div., Westinghouse Electric Corp.

Frank R. Freyler has been promoted to manager of Allis-Chalmers' Mid-Atlantic region.

American Brake Shoe Co. has consolidated all operations of its Canadian subsidiaries into one corporation, Dominion Brake Shoe Co., Ltd.

Laclede-Christy Co. has taken over the assets and liabilities of the Chicago Retort and Firebrick Co.

New address for Syntron Co.'s New York sales and engineering office is 1860 Broadway, New York 23, N. Y.

Its the O'Brien Industrial Equipment Co. that will be sales representative for Erie Mfg. Co. in San Francisco.

Richard S. Wharton has joined Hewitt-Robins, Inc., as sales manager of the Hewitt Rubber Div.

J. E. Ryan and C. P. Hayes have been appointed staff assistants to B. A. Case, manager of engineering of General Electric's Small Apparatus Div. Dr. John H. Lux has been appointed manager of the New Product Development Laboratory and Dr. Ernest O. Ohsol is now manager of Chemical Process Development.

W. M. Hurley has been promoted to works manager of the East Alton plant of Olin Industries, Inc.

Apparently demand for magnesium sheet has improved because Aluminum Company of America plans to establish a new division for rolling magnesium sheet at its New Kensington (Pa.) plant.

J. E. O'Connor, age 28, has been named manager of Packing and Special Products Sales Department, Goodyear Tire and Rubber Co.

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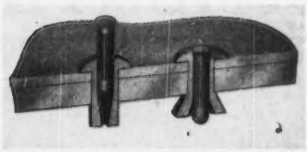
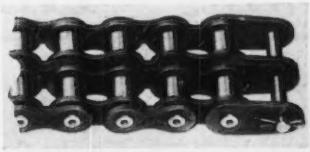


RIVET is installed simply by striking the inserted pin with an ordinary hammer. Drive-Pin Rivet forms permanent fastening. Available: Cherry Rivet Co., Los Angeles, Calif. (12)



ROLLER CHAIN construction combines riveted chain's longer life and lower cost with cottered roller chain's ease of disassembling. Available: Chain Belt Co., Milwaukee, Wis. (13)

Equipment Shorts

V-BELT. Manufacturer claims 40% increase in horsepower rating over comparable sizes of standard V-belts. Increase in capacity was effected without stiffening the belt or reducing safety factors. Available: B. F. Goodrich Co., Akron, Ohio. (31)

SOLENOID VALVE. Uses solenoid-actuated pilot rather than conventional direct pull of solenoid on sealing mechanism. Solenoid can be replaced without changing valve. Built for ½ in. size only, the 3-piece valve weighs only 5¾ lb. Available: Galland-Henning Mfg. Co., Milwaukee, Wis. (32)

PROTECTIVE COATING. Ready-mixed, abrasion and corrosion resistant Vinyl plastic coatings (trade name—"Calvinac") can be applied to wood or metal by brush, spray or dipping. They are air drying and non-toxic. Available: James Lithgow Co., Inc., Los Angeles, Calif. (33)

ELECTRIC HAMMER. Light weight electric hammer operates almost without vibration. Weighs only 7½ lb. Available: Noble & Stanton Inc., Bedford, Ohio. (34)

GEARTURBINE. Steam turbines with close coupled, integral reduction gears permit equipment such as pumps, fans, compressors and generators to be driven at their proper speeds, while the turbines operate at their most efficient speed. Available: Westinghouse Electric Corp., Pittsburgh. (35)

CHIPPING HAMMER. New line of air-powered chipping hammers offers a selection of 15 power sizes with five basic hammer sizes. Available: Ingersoll-Rand Co., New York. (36)

CHAIN-BREAKING VISE. Steel jaw chain vise accommodates all American Standard sizes of roller chain from ½ to 2½-in. pitch, single and multiple widths. Settings are accurately maintained. Available: Morse Chain Co., Detroit 8, Mich. (37)

AIR HOSE. Condor Homoflex heavy duty air hose has a strong tube compounded of oil-proof Flexlastics, two braids of heavy strength member, and thick abrasive resistant, oil-proof Flexlastics. Two sizes, ¾ and 1-in. are being made with working pressures of 350 and 300 lb. Available: Raybestos-Manhattan, Inc., Passaic, N. J. (38)

HYDRAULIC WORKING PLATFORM. Mobile 27-in. square platform can be hydraulically raised to a height of 17 ft. Enables operator to work at heights 22 to 23 ft. above the ground. Toe boards, hand rail provided. Folds up when not in use. Available: William Moss & Sons, Ltd., London, England. (39)

HOT WATER. Compact heaters provide from 3,960 to 31,500 gph. hot water instantly and noiselessly, for change room showers or what-have-you. Unit uses steam, can be regulated manually or automatically. Is easy to clean. Available: A. Gunthard Co., Ennis, Texas. (40)

GEIGER COUNTER. Size—approximately 3½x4x6½ in. Weight—3½ lb. Ranges—20, 2 and 0.2 milliroentgens per hour. Price, complete with batteries, earphone, tubes and carrying belt—$99.50. Available Precision Radiation Instruments, Inc., Los Angeles, Calif. (41)

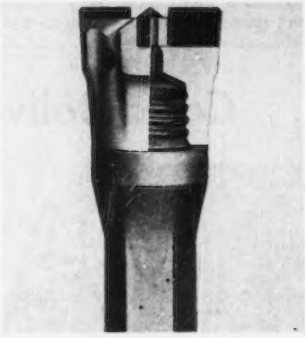
ULTRA-VIOLET LAMP. Low cost adapter allows Mineralight (Model SL) ultra-violet lamp to operate on 110-v.d.c. in addition to 110 v.a.c. Available through supply houses: Ultra-Violet Products Co., South Pasadena, Calif. (42)

LEAD LUBRICANT. "Lead-Lube" provides lead coating for lubrication of all types of metal surfaces. Fills scars and pits, prevents uneven wear and reduces noise. Available: Knapp Mills, Inc., New York. (43)

JETTING PUMP. Self-priming jetting pump puts out 400 gpm. at 150-psi. pressure. Offers advantages for hydraulicking. Available: Sterling Machinery Co., Kansas City, Mo. (44)

PUMP. Turbine type pump with impeller fastened to an enlarged shaft by a lock nut and a woodruff key eliminates metal-to-metal contact. Roy E. Roth Co., Rock Island, Ill. (45)

ILLUMINATED BACKSIGHT can be seen by surveyors for more than 1,000 ft. from any angle. Two-cell unit costs $27.50; three-cell, $30.00. Plastic Shop, Butte, Mont. (14)

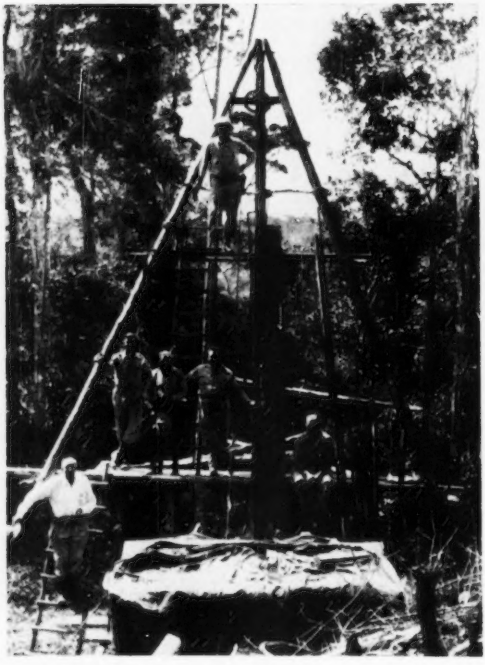


BIT ATTACHMENT for Carset Jackbit is shoulder type using patented 38-deg., reverse-buttress thread to resist shock, reduce wear. Ingersoll-Rand Co., Phillipsburg, N. J. (15)

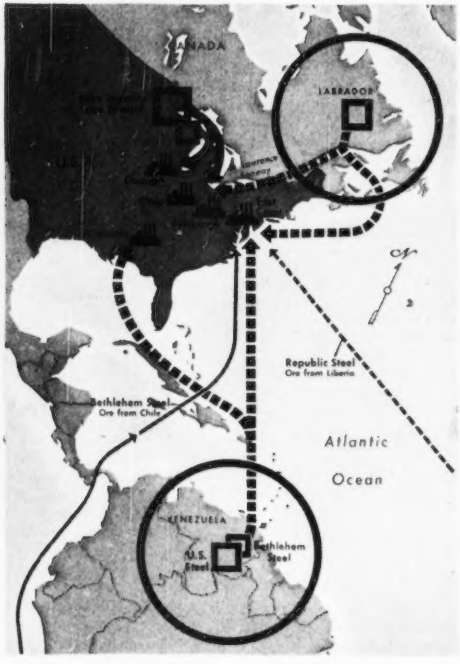
FLOW GAGE (Magna - Sight) comes in sizes from ¼ to 4 in., maximum capacities from 3.5 to 250 gpm. One glance tells flow rate. Fischer & Porter Co., Hatboro, Pa. (16)

CERRO BOLIVAR iron range compares favorably in size and grade with Lake Superior's Hull-Rust-Mahoning pit. Orinoco Mining Co., newly formed subsidiary of U. S. Steel will undertake mining the huge orebody.

Cerro Bolivar,—Iron Ore in Venezuela



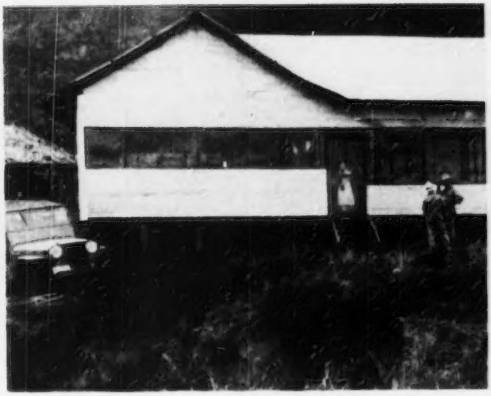
HEADING the Venezuelan project are (top) H. C. Burrell; (platform, l. to r.) Fred Wright, Forbes Cronk, William Boeckman and F. H. Kihlstedt. Mack C. Lake (ladder), exploration chief, is Orinoco president.



ADD VENEZUELA to the large new iron ore reserves that will be available for American steel-making in Labrador and Quebec and elsewhere abroad, as soon as mining and transport facilities have been constructed.

IN MINING

EXPLORATION PARTY, under Lloyd Severson, Oliver Iron Mining Co. engineer, reports to Mack C. Lake.



IRON ORE BOULDERS surround the cook shack and dining room at the camp on Cerro Bolivar.

IN THE UNITED STATES

- Oliver Iron Mining Will Tackle Taconites — P. 143
- CIO, Mine-Mill Spar in Utah — P. 149
- Geiger Counter Sprouts Wings — P. 136

ALASKA

★Gold mined in Alaska last year totaled 220,903 troy oz., valued at $7,731,605, as compared to 248,395 oz. worth $8,693,825 the previous year, according to figures released at Juneau by the Federal Bureau of Mines.

Total mineral value was $11,355,000, down from $12,028,000 in 1948. Coal ranked second to gold, with 430,000 tons valued at $2,205,900, up in tonnage but down in value from 1948.

Silver production of 36,230 oz., largely the byproduct of bucketline gold dredges in the Fairbanks area, was down 46%. Some of it came from lead mines in the Hyder district.

★George Hellerich will return to Caribou Creek near Fairbanks as manager of the Brinker-Johnson gold mining operations this season, after a year's absence while he managed the Poole-Johnson operation in the Nome district. Bruce Thomas, Caribou Creek manager last season, has gone to Livengood, where he will be superintending engineer for Manager Dan Beyers under the new set-up of **Callahan Zinc-Lead.** The Callahan firm is operating engineer for the Livengood prospect, on which work is being resumed this year.

★**U. S. Smelting, Refining & Mining Co.** reported to stockholders that its net income during the first eleven months of 1949 was over 65% less than during the same period in 1948. The total was $640,719, compared with $2,519,423. The company paid a quarterly dividend of 25c. on common shares Jan. 14, and an 87½ c. dividend was declared on the preferred shares.

★The 16-person staff of the U.S. Bureau of Mines at Juneau, Alaska, has moved from the Federal Building into the Bureau's new building on Juneau Island. The building work, extending over a year, cost $300,000.

★Delegate E. L. Bartlett reported in February that unless some unusual circumstances should arise, he would not introduce legislation to suspend assessment work on mining claims in Alaska. By July 1, $100 worth of labor

Coming Meetings

April 11, 12—American Zinc Institute, St. Louis, Mo.

April 12—Southwestern Section New Mexico AIME.

April 14—Rio de Janeiro Section AIME.

June 19-30 — Northwest Resources Institute, Oregon State College, Corvalis.

July 30, 31—Mining Association of Montana, Butte, Mont.

Oops!

In the article on silver in our February issue, reference was made on page 81 to the quantity of silver in the Treasury's general fund. This was inadvertently given as 90 million ounces. Actually there were 171 million ounces in the general fund, of which the cost was $94 million.

The Spotlight is on LIDDICOAT

Pioneer in the field of Single Use Bits

Through the years over the "rock drilling circuit", the Liddicoat bit has received "top billing" as the "star performer" of mining operators and contractors everywhere.

The Liddicoat bit was a natural from the start. Experience of the years, plus extensive research, has added to its many talents.

Today, Liddicoat bits are world famous because:

1 - **Their cost is extremely low**
2 - **Labor involved is at a minimum**
3 - **They are easily attached and removed**
4 - **They are used to destruction, then thrown away**

For better and cheaper drilling, contact

WESTERN ROCK BIT MANUFACTURING COMPANY

Manufactured for sale in 11 western states, the Philippines and Alaska by Western Rock Bit Mfg. Co., 552 W. 7th So., Salt Lake City.

CALUMET-HECLA CONS. COPPER COMPANY

Manufactured for sale in the 37 eastern states by Calumet-Hecla Consolidated Copper Company of Calumet, Michigan, U. S. A.

Backed by 25 Years Experience with Storage Battery Locomotives

2-motor drive; total 24 h.p.

Series parallel controller.

Extra long journal springs for better trackability.

Oil-tight, leakproof transmission. Use auto oil, renew every 6 months.

Adjustable Timken Roller Bearings throughout.

Strong, simple construction. Low maintenance.

GREENSBURG "RANGER"

The Sunshine Mining Company, Kellogg, Idaho has three of our locomotives which have contributed materially toward decreasing their haulage cost. This is a custom-built job.

All Greensburg Locomotives are CUSTOM-BUILT to your requirements.

GREENSBURG MACHINE CO. 102 STANTON ST. GREENSBURG, PA.

Alaska *(Continued)*

or improvement on each mining claim must be completed. At Bartlett's request an inquiry was being made to determine whether there was a desire for an extension of Public Law 735. Alaskan Mines Commissioner, Leo H. Saarela reported contacting about three dozen companies early this spring. However, Director Clawson of the Bureau of Land Management said, "I know no special circumstances this year which would justify further suspensions of the mining assessment work requirements. Failure to perform even this much labor or improvement of mining claims strongly indicates a lack of an honest intention to develop the minerals on the claim. Any move to provide further suspension would be strongly opposed." With this attitude from the Interior Department, a further attempt to legislate for suspension would seem rather futile.

★In a test case filed by the **Alaska-Juneau Gold Mining Co.** of Juneau and Luther Hess, Judge Harry Pratt has issued a temporary injunction in district court at Fairbanks restraining further collection of property taxes by the Territory under a new law enacted last year. The complaint lists 15 points on which the law is declared to be faulty or inconsistent with the organic act or federal laws.

★The Alaska Miners' Association, which meets at Seattle, Wash., during the winter months, has elected the following directors:

Nome area — Jack Allen, Graham Lammers, Walter Johnson, Ralph Lomen and John Repo.

Anchorage area—Chris Polson, W. A. Dunkle, L. McGee, Harold Strandberg and Al Dodson.

Kuskokwim area — Charles Johnston, James Crowdy, Alex Mathisen, John Miscovich and Gus Uotila.

Fairbanks area—Glenn Carrington, Charles Herbert, Roy B. Erling, A. E. Lathrop and Harold Christiansen.

Southeastern area—J. A. Williams, E. N. Patty, H. L. Faulkner, Jim Dodson and Norman Stines.

ARIZONA

★New contracts with the International Mine, Mill and Smelter Workers Union have forestalled a strike threat against Miami, Ariz., copper operations. Affected are **Miami Copper Co., Inspiration Consolidated Copper Co.,** and **International Smelting and Refining Co.**

New contracts call for a 5c. an hour increase, and:

1. The union's right to reopen the wage issue should the companies reduce operations from six to five days a week;

2. An insurance plan covering off-the-job accidents and sickness to be negotiated within 60 days;

3. A 7-day notice in case of major curtailment of operations, and;

4. Seniority protection of workers suffering illness or off-job accidents.

★Copper production at Bisbee, Ariz., and leaching of ore in Nacazari, Mex., will be started again this year, according to Cleveland E. Dodge, vice president of Phelps Dodge Corp., operator of the properties.

The units have been down in recent months following a general industry cutback.

CALIFORNIA

★Frank M. Darrow, Trona, Calif., chemical engineer, has filed an anti-trust action for $1,500,000 damages against the American Potash & Chemical Co., the Trona Railroad Co. and three individuals.

Darrow's complaint alleges he was barred from exploiting valuable sodium deposits in the Searles Lake area of the Mojave Desert to which he had obtained mining rights under a federal permit. He had expected to net approximately $500,000 from the sale of the sodium and sued for three times that amount under provisions of the Anti-trust Act.

Individuals named as defendants were Peter Colefax, president of the American Potash & Chemical Co.; J. L. Robinson, president of Trona Railroad, and A. J. Anderson, president of the chemical company's Trona plant.

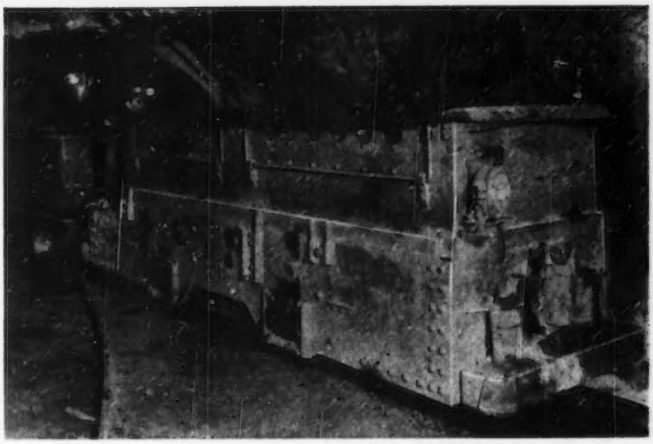
★**Julian Milling Co.** has announced plans to re-open operations on a 115-ft. shaft which is expected to lead to a rich gold vein near Julian in San Diego County. President of the recently organized company is W. R. C. Mitchell, a San Diego painting contractor.

★**Rare Metals Corp.**, 18 mi. southeast of Newberry, has begun expansion of its gallium separation mill, changing over from chemical to electrolytic equipment.

C. L. White, officer of the firm, said the installation would provide a less expensive method of separating gallium from ore dug on the site. Rare Metals is one of two commercial producers of the metal in the United States. The firm has claims extending several miles south of its mill.

★**Whinnery Mining Co.** planned to resume milling this spring of gold ore at the Sarita mine in the Masonic district at the rate of 100 tons daily. Winter snows halted operations. Manager Page Blackmore reported the Mono County property contains some 100,000 tons of mill-grade ore. The company also plans exploration and development of the adjoining Chemung property, a former gold-silver producer.

★**Gold Crown Mining Corp.'s** group of eight claims in the Alleghany area is being developed. The old 78-ft. shaft of the Wonder No. 2 claims has been



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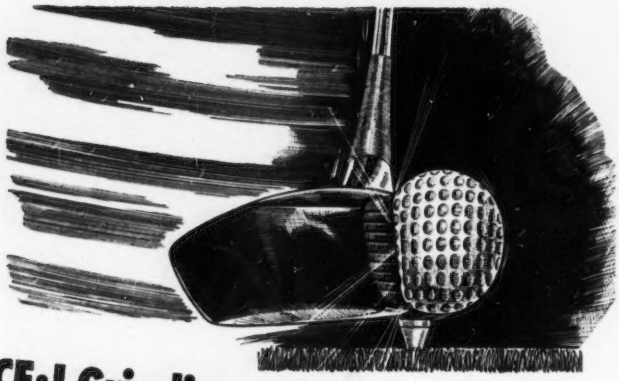

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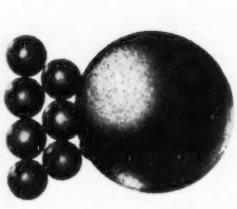

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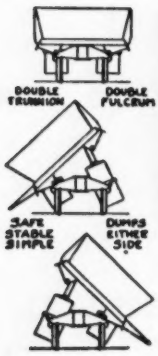

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California *(Continued)*

reconditioned and a 100-ft. tunnel driven.

The adjacent Sixteen-to-One property is being operated at capacity by **Original Sixteen-to-One Mining Co.**, employing 56 men and treating 100 tons of ore daily.

Also in the Alleghany region, American Hill and Pilgrim Lode Annex gold properties are being rehabilitated by **Cadmus Mines.**

★A profitable gold vein is being mined in the south end of the Royal Mine in the Copperopolis area in Calaveras County by Frank Tower and associates. Milling is done with 10 stamps.

★Fresno County board of supervisors has granted permission to Fred Santoni and Fred Williams to conduct a small scale suction type dredging operation in the dry river bed of the San Joaquin below Friant.

Another application is pending before the board, that of Oliver J. Hesselgren, Jr., to operate a placer type dredger in an 8-mi. stretch of the San Joaquin below Kerckhoff Dam.

★**Idaho Maryland Mines Corp.'s** 1949 operations resulted in an estimated net profit of $190,000 before, and a net loss of about $15,000 after allowance for depletion and depreciation. This compared with 1948 figures of a net loss of $83,822 before, and $243,307 after, E. L. Oliver, president, announced.

Diamond drilling has resulted in discovery of two new veins of considerable potential value, he said. One vein was shown in five holes over a length of 700 ft. drilled from the 2,400-ft. level. The other was disclosed in only one hole. Both veins must be opened up by drifts and raises before their value will be known, as it is not possible to estimate tonnages from diamond drill cores in this type of vein.

Active exploration and stoping of orebodies found on the 2,700-ft. level late in 1948 was expected to start in March on completion of pumping and station facilities.

Development of the area had been delayed because of lack of adequate ventilation and means for rapid conveyance of ore and disposal of waste. Recent completion of a large raise from the 3,280-ft. level has improved ventilation.

★Red Point Mine property and its stand of timber in Placer County was sold late in February for $20,200 to William Hughes and Winifred Akins of Forest Hill. The mine is said to have produced $1,000,000 in gold during its operation.

★Total value of mineral production of California for 1949 is estimated at $1,103,127,000 by the statistical department of the Division of Mines. This is a decrease of about $71,547,000 from the 1948 total of $1,174,674,000, resulting from lower production of petroleum coupled with lower prices

for the lower gravity crude oils. Increases in quantity and value were shown by silver, copper, zinc, natural gas, natural gas gasoline, and liquefied petroleum gases. Decreases were shown in quantity and value of petroleum, gold, mercury, cement, miscellaneous stone, and sand and gravel. Estimated metals produced during 1949 are as follows: gold, 410,310 oz.; silver, 786,300 oz.; copper, 1,320,000 lb.; lead, 20,260,000 lb.; zinc, 14,600,000 lb.; and quicksilver, 6,500 flasks. The value of other metals, including chromite, iron ore, molybdenum ore, platinum metals, and tungsten ore amounted to $3,250,000. The estimated value of clay products was $22,000,000; industrial non-metallic minerals (including lime, pumice, diatomite, gypsum, talc, and others) $16,100,000; and that of salines, $33,750,000.

★Development and exploitation operations are underway at the Yaney mine situated about 5½ mi. southwest of Bishop, Inyo County. Originally opened up as a gold mine, tungsten ore containing up to 2% WO_3 has been discovered. Principal ore mineral is ferberite which occurs as small, black, pyramidal crystals in a gangue of opaline silica. Mined ore is hauled 2½ mi. to the Bishop Antimony mine for crushing, and jig and table concentration. Concentrates are sold to the **Molybdenum Corporation of America** buyer in Bishop. The Yaney mine and the Bishop Antimony mine mill are under lease to B. W. Van Voorhis and R. W. Adams, of Bishop and Lone Pine respectively.

Cap and Gown

Several Henry Krumb scholarships will be awarded to students from Columbia College or other institutions who are accepted for admission in the School of Mines, Columbia University and who desire to pursue work for B.S., E.M., or M.S. degrees. Value of scholarship is $1,000 plus transportation costs to New York City. For further information write to P. B. Bucky, Executive Officer, School of Mines, Columbia University, New York 27, N. Y.

University of Washington offers 5 fellowships in the School of Mineral Engineering for research in Coal and Non-metallics in cooperation with the U. S. Bureau of Mines. Duties begin July 1 or September 1. Monthly payments will add up to $1320 for the year. Write Drury A. Pifer, School of Mineral Engineering, University of Washington, Seattle 5, Wash.

University of Southern California has added course in ore-dressing and metal mining to the spring schedule of the evening study division.

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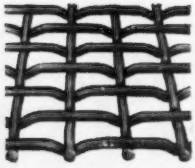

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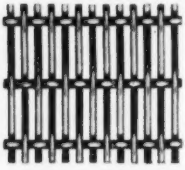

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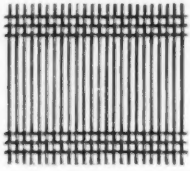

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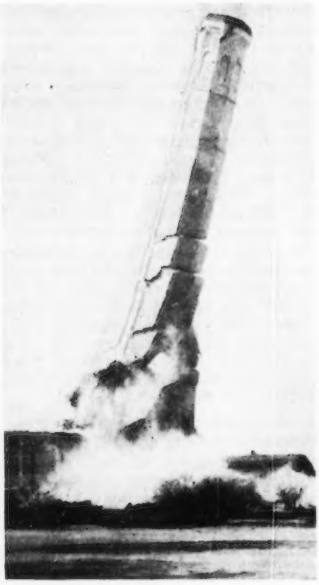


THE BIGGER THEY COME, the harder they fall! Demolition men recently put the coup de grace on the 350-ft. stack of the Grant smelter in Denver (left) and on the 300-ft. stack of an old lead smelter at Durango, Mexico.

California *(Continued)*

★A three-months strikes of some 450 employes of the American Smelting & Refining Co.'s Selby plant ended in mid-March when they were granted a 10c.-an-hour wage increase. The IUMMSW members originally asked an increase of 18½c. to their $1.29 basic scale.

COLORADO

★Paul R. Clark and Richard E. Mackley of the **Clark-Mackley Co.** are continuing development work at the Fortune mine at Leadville owned by the James McNeece estate. Kokomo properties formerly operated by the Clark-Mackley Co. are down temporarily.

★**Gold Empire, Inc.**, of Cripple Creek, plans to resume mining operations soon on properties at Gold Gulch and Rosebud Hill. Clyde T. Carson, president and general manager of the company, reports that the first operation will consist of re-timbering about 300 ft. of the Mary Nevin shaft. Carson stated that the shaft would be two-compartment and equipped with a skip to handle increased ore production.

★**Champion Mines Co.** at Cripple Creek has deepened the Forest Queen shaft 200 ft., to a depth of 1,150 ft. where a station is being cut. Jesse Simmons, president of the company, says that lateral development will be pushed into WPH, Jerry Johnson and Montrose properties as well as the Forest Queen.

★**American Smelting & Refining Co.** treated 140,000 tons of charge at its Leadville smelter in 1949. Of this total, 120,000 tons was ore. Ore receipts were as follows: Leadville-Gilman districts, 3,000 tons; San Juan-Silverton-Ouray districts, 2,000 tons; Idaho Springs-Georgetown districts, 1,000 tons; and about 4,000 tons from other outlying districts and foreign countries. Three hundred men were employed in handling, treating and smelting ore received.

★**AS&R's Victory** mine at Kokomo presently employs 84 men and is producing about 9,000 tons of ore per month. During the first part of 1949 some exploration was carried out at the Robinson and Wilson mines near the Victory property, but these projects were halted with the 1949 drop in metal prices. AS&R has continued exploration work on the 1,000-ft. level of the Eclipse shaft, east of Leadville, on a project known as the Ibex-Sunday. The horizon being explored is below the water table, and more than 2,000 ft. below the surface.

★**Silver Bell Mines Co.** operating the Silver Bell mine at Ophir shipped substantial tonnages of gold-silver-lead-copper concentrates to the U.S. Smelting, Refining & Mining Co. at Salt Lake City last year. A new 1,140-cu. ft. compressor has recently been installed, and a new washing-sorting

plant is nearing completion. The flowsheet involves washing, sorting of waste, and two-stage crushing. This is expected to increase mill capacity to 200 tons per day. Research has started on the recovery tungsten as a byproduct.

★John H. East in charge of U.S. Bureau of Mines tunnel project at Leadville reports that invitations to bid on a 3,500-ft. extension of the drainage tunnel were mailed to 55 tunnel contractors. Bids were scheduled to be opened on Feb. 28.

★**Leadville Lead Corp.** reports the discovery of a large lead-silver orebody in the Horseshoe district. C. Kem, president of the firm, said that the newly discovered deposit is 20-ft. wide. The company will now complete the Dauntless tunnel to the Leadville side of the Mosquito range to provide an outlet for the ore. The mile-long 8x8-ft. bore will emerge 6 miles from the AS&R Leadville smelter. Otherwise an 85-mile ore haul would be necessary. The tunnel will cost $150,000 to $200,000, and will be driven by Harry L. Sinclair Co., Denver, in return for a royalty on the ore.

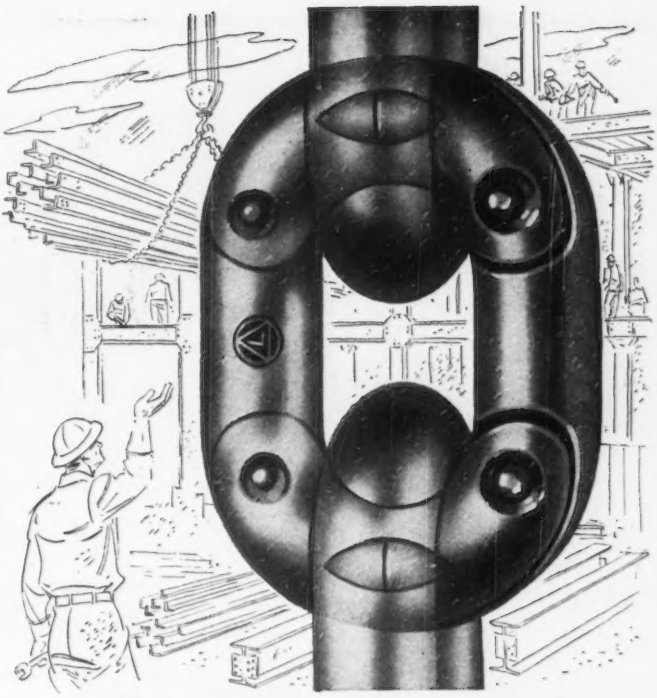
★The Denver mint reports receipt of 55,473 oz, of gold, valued at $1,941,574 for Jan., 1950, as compared with receipts of 34,850 oz. valued at $1,219,700 for Jan., 1949. Silver receipts were 17,101 oz. valued at $15,190 in Jan., 1950, and 9,894 oz. valued at $8,681 in Jan., 1949.

★**Aspen Mining Co.**, controlled by Anaconda Copper Mining Co., Humphreys Gold Corp. of Denver, and J. W. Patterson of Salt Lake City started an exploratory program in the Aspen district last year. Underground development has been confined to Smuggler No. 1 and Smuggler No. 2 tunnels on the Smuggler Mountain and the lower Durant tunnel on Aspen Mountain. Diamond-drill exploration will continue on the Smuggler Mountain orebodies. F. W. Anderson, manager of the Aspen Mining Co., said that underground work has been discontinued recently, but that work would continue with churn drills.

★**Vitro Manufacturing Co.**, a Pennsylvania firm engaged in uranium processing, has purchased 17 acres in the industrial section of Grand Junction. A uranium plant, reportedly costing more than $500,000, will be built on the site. In the past the firm has extracted uranium at its Canonsburg, Pa., plant. Uranium was used as a colorant. Vitro recovers all value in the ore including radium.

IDAHO

★**Sunshine Mining Co.** reports a production of 156,027 tons of ore in 1949 having a gross value of $4,929,603. Output would have been 25% greater if it had not been for a two-month labor strike. Average assay value of



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E & M J REPORT

Geiger Counters Are now Airborne and Carborne

THE U. S. GEOLOGICAL SURVEY announces that it is using airplanes and light trucks carrying Geiger counters to speed the search for domestic uranium sources. "More uranium than ever" will be needed for the construction of new types of bombs, according to the U.S.G.S.

The airborne equipment shown above employs technique similar to those used in the airborne magnetometer surveys. These include the continuous determination of plane position, and recording of data obtained by geophysical instruments. In the Geiger-counter equipment, background noise due to cosmic radiation has been cut down by means of a one-inch lead shield above the Geiger counters to reduce the soft component of the cosmic radiation. A special arrangement of counter tubes in hexagonal bundles directly below the shield allows the hard component to be reduced. With cosmic radiation thus reduced, gamma radiation from the ground can be measured more accurately.

A radioactive radon gas is known to escape from radioactive ores, the plane is also equipped to monitor the atmosphere through which it flies. Air flow from an intake in the nose of the plane is led back to an air conductivity meter. It is hoped that this instrument can make a continuous record of the ionization of the atmosphere due to radon escaping from radioactive ores.

Weight of the equipment, exclusive of power source, is approximately 1,400 lb. U.S.G.S makes it clear that this equipment, now in the development stage is intended to supplement, rather than take the place of, prospecting by private individuals.

The Survey has also speeded up prospecting with a car-mounted model shown above. Here two 42-in. Geiger tubes are mounted on the roof of the car. The counting rate meter, modified for rapid responses, includes an alarm circuit set to signal when the number of radiations detected reaches a predetermined rate. This is shock-mounted in the instrument panel. Such equipment permits pospecting along roads at an average speed of 30 miles on hour. Total weight is 25 lb.

Close on the heels of the above release by U.S.G.S. comes an announcement that Geiger equipment suitable for mounting in airplanes is offered by a dealer. See Equipment Previews page 124.

Idaho *(Continued)*

the entire tonnage milled was 30.89 oz. of silver, 2.47% lead and an unstated percentage of copper and antimony. The actual metal recovered, as represented by smelter returns, was 4,739,523 oz. of silver, 7,542,222 lb. of lead and 1,243,665 lb. of copper.

★**Day Mines, Inc.**, reports a net loss of $98,821 for the fourth quarter of 1949. Low prices for lead and zinc and the two months' miners strike are given as the reason.

Production came from six different company-owned sources in four different vein systems, all of which are operated through Sunshine under separate contract agreements.

★**Polaris-Silver Summit** now has three levels in high-grade silver-copper ore, the 3,000, 3,200 and 3,400-ft. levels, all of which are being made ready for production. The next development will be on the 3,600-ft. level, to which point the shaft has been completed. The concentrates from this orebody average around 700 to 1,000 oz. in silver and about 17% copper per ton.

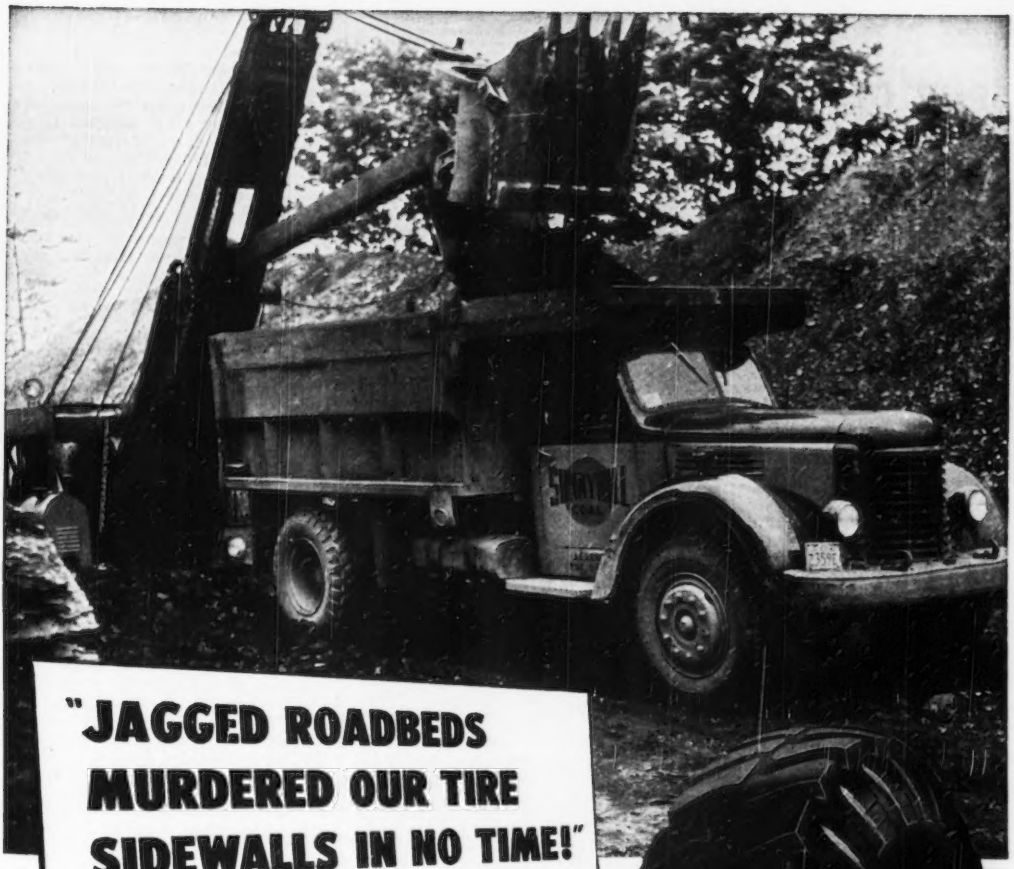
★The Galena shaft in **Lake Gulch** west of Wallace, which is being put down to the 3,000-ft. level by the AS&R and the Day Mines, Inc., is down to the 2,600-ft. level. It was to be completed by about June, but faulty ground encountered will delay work temporarily.

★**Golconda Lead Mines Co.'s** annual report for 1949 shows a net profit of $36,052, after depletion, depreciation and taxes. The company's gross income for 1949 was $241,270, of which $155,853 was smelter returns on ore produced from the Golconda mine property and the balance from custom milling.

★**Day Mines, Inc.** has started a ventilation raise on the new vein of ore recently discovered on the 1,000-ft. level in the old Hercules mine at Burke. After discovery, the ore was exposed by drift for more than 100 ft. The raise will be extended 200 ft. to a connection with the 800-ft. level, after which drift prospecting will be resumed.

★In sinking 150 additional feet from the 300-ft. level the **Clayton Silver Mines Co.** has opened an entirely new ore shoot in a crosscut started for the ore shoot which has been the producer on the 300-ft. level. The new orebody averages 5% lead and 6 oz. in silver per ton, and is about 20 ft. wide and 60 ft. long.

★V. F. Hammerand, geologist for the **Nabob Mining Co.** on Pine Creek, explains that there are two big vein systems showing in Nabob's 6,000-ft. development tunnel, each of which carries three parallel veins. Drift work has been started on the Nabob structure driving easterly on the middle



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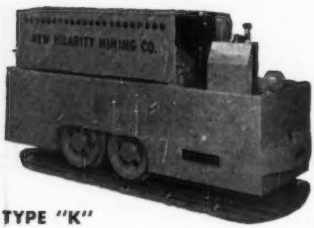

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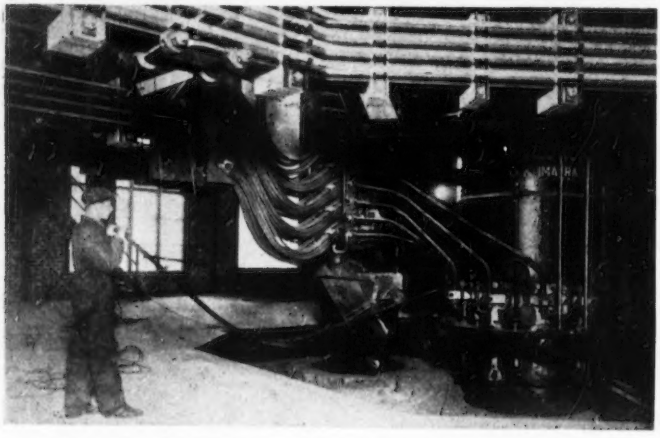

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(HEAD OFFICE: OSLO, NORWAY)

Idaho *(Continued)*

vein, believed to be the same mineral fissures as the Sidney mine, while diamond drill holes will be used at intervals on the other two veins. A similar procedure will also start on the middle vein of the "Crystolie" vein structure but the drift will be driven to the east. This work is now going forward while leasers are producing ore from the upper Nabob workings.

★A cave-in of underground workings at the old **White Knob mine** at Mackay, Idaho, recently buried about $2,000 worth of mining equipment, but nobody was injured as the cave occurred between shifts.

★**Grandview** zinc-lead mine at Metaline Falls, Wash., has stepped up production since work was resumed following a 14 months' mine labor strike. January output of the mine was 19,110 tons of ore, according to D. I. Hayes, district manager for the American Zinc, Lead & Smelting Co.

★Three crews of miners are pushing new deep development work in the **Sunshine Consolidated** mine on Big Creek, adjoining the Sunshine mine on the west. One crew is driving a new crosscut tunnel from Sunshine's 2,700-ft. level. This crosscut has been advanced 1,700 ft. and has about 700 ft. to go to reach the objective point where diamond drilling indicates the vein is 3 ft. wide of rich silver ore. Another crew is driving a raise from the 3,100-ft. level to connect with this 2,700-ft. level crosscut and now has this work completed for 250 ft. Still another crew is mining 6 to 8 tons of ore per day from stopes on the 3,100-ft. level, according to Norman M. Smith, manager Sunshine Consolidated is onerated and half owned by Sunshine Mining Co.

★Sinking operations have now been completed to the 1,400-ft. level by the **Spokane-Idaho Co.**, operating the Constitution mine on Pine Creek, according to J. B. Keiffer, general manager. The shaft is being another 200 ft. The mine ranked as the eighth largest zinc producer in Idaho last year.

★**Lucky Friday Silver-Lead Mining Co.** has shipped 3,500 tons of ore to the Golconda custom mill. The previous shipment of 4,700 tons netted the company smelter returns of approximately $80,000. The company has completed stopes on the 1,600-ft. level and will resume drifting easterly on the vein from that point. Production is now coming from the 1,600, 1,400 and 1,000-ft. levels.

★The **Mike Horse** mine near Helena, Mont., which is operated by AS&R through its Federal Mining Co., of Wallace, has reduced its operating force from 140 to about 30 men on account of lower-grade ore.

★**Gibbonsville Mining Co.** will make another attempt at saving the tailings values in the flats below the Bunker Hill mine at Kellogg, which are estimated to contain 41,800,000 tons.

IRON COUNTRY

★**Skubic Brothers**, of Virginia, Minn., shipped 85,461 tons of ore from the Ajax mine at Biwabik in the 1949 season.

★Governor Youngdahl and the state executive council, at a meeting held late in January, unanimously agreed to reject all 53 bids for permits to prospect for iron ore which had been presented. They deferred action on 25-year lease extensions for Tioga mines No. 1 and No. 2 (which expire in 1956) near Grand Rapids and are held by **Pickands, Mather**.

Lease extensions were approved on the Kevin mine, at Nashwauk, operated by **Butler Brothers** and the **Wheeling Steel**'s Wacootah mine at Mountain Iron.

★A public hearing to be held in the St. Louis County courthouse at Virginia Mar. 16 on the application of **Erie Mining Co.** and **Pickands, Mather & Co.** for water rights to operate the taconite plant at Aurora. The application asks the right to make a channel between Colby and Whitewaters Lake (Upper and Lower Partridge Lakes). Rights to construct retaining dams and to pump water "not to exceed an average of 12,000 gpm." are also asked. Because of the large amount of water required, the matter of a sufficient supply will be a very important one in the location and operation of future taconite plants.

★Total mine valuation for Iron County (Menominee Range) for 1950, as recommended by Frank G. Pardee, deputy state geologist, are $19,325,000, an increase of $1,455,000 over 1949. Mr. Pardee estimates Iron County iron ore reserves at 55,036,000 tons; Marquette County at 65,110,000 tons and Gogebic County at 29,099,000 tons. Michigan's total reserves are estimated as 153,526,000 tons, valued at $58,474,000.

★A study of ground-water problems in the Iron River district by Wilbur T. Stuart, engineer with the U. S. Geological Survey, discloses that pumping the water in some wet mines of the west side costs "more than 30c per ton." In some mines over 35 tons of water are pumped for every ton of ore produced.

★**Inland Steel Co.** has leased from **Oliver Iron Mining Co.** the Youngstown mine at Crystal Falls.

★At **Jones & Laughlin Ore Co.'s** Vicar mine, near Wakefield, the 24-in. belt conveyor for transferring ore from the headframe to the transfer tower is now in operation. Use of the conveyor kept the headframe height at a minimum, materially reducing its cost. The conveyor is on a 16-deg. incline to the tower and travels 450 fpm.

★**A. Lindberg & Sons** have begun removing iron ore from the East End open-pit mine of **Cleveland-Cliffs Iron Co.** at Ishpeming. Most of the surface has been moved and it is planned to

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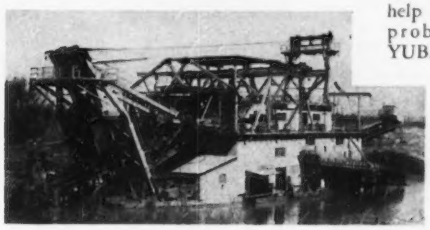
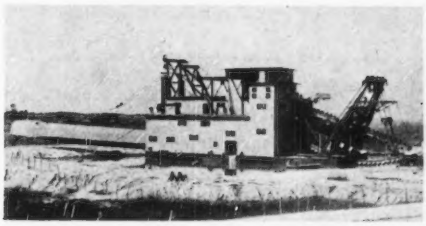


California — YUBA Dredge No. 98, with wood hull, 9 cu. ft. buckets, 30′ digging depth, recovering gold for La Grange Gold Dredging Co.



Korea — YUBA Dredge No. 79, steel hull, 10 cu. ft. buckets, 33′ digging depth, gold mining.

Yukon — Digging gold near Dawson for Yukon Consolidated Gold Corp. YUBA dredge with wood hull; designed for Arctic conditions. 7 cu. ft. buckets, 25′ digging depth.

Montana — Perry & Schroeder Mining Co.'s dredge, built with pontoon-type hull, 6 cu. ft. buckets, and 38′ digging depth for mining gold, garnets and sapphires; now being used for backfilling cofferdams at Canyon Ferry Dam site and for excavating aggregate.

Malaya — Kampar Malaya No. 1, with steel hull and 10 cu. ft. buckets, digging tin at depths to 75 ft. below water.

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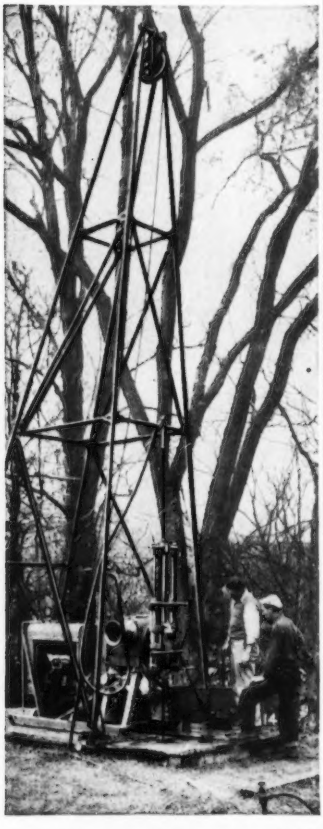

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R. T. ELSTAD, president of Oliver Iron Mining Co., who last month disclosed that company's plans for a plant to treat taconites. For details, see below.

Iron Country *(Continued)*

mine all the ore before the spring breakup prevents further mining. The ore is being stockpiled at the Old Lake Shaft mine for later loading into railroad cars.

★**M. A. Hanna Co.'s** mines on the Menominee range are busy with winter development and mining for stockpiles. The deepening of the shaft at Hiawatha No. 2 has been completed to the 19th level.

A new level is being developed at the Wauseca mine and underground exploration work is underway at the Tully, through the Bengal mine shaft.

★**Oliver Iron Mining Co.** is starting to build an agglomeration plant at Virginia for processing Minnesota taconite concentrates and fine ores. Reference to this project was made by R. T. Elstad, president of the Oliver company, in a recent address before the Virginia Chamber of Commerce. According to Mr. Elstad, this experiment is one of the steps in a $17 to $20-million program to secure basic information before the company undertakes to build a commercial taconite plant. The program includes five major stages: exploration, research, mining, separation and agglomeration.

The new plant, operating on a 24-hour schedule, will have a capacity of approximately 1,000,000 tons of finished product per year. The site adjoins the present Rouchleau crushing and screening plant because of unloading and working facilities there, and will cover about three acres. It is to be completed in 1950 and will be constructed for the Oliver company by Arthur G. McKee Co., Cleveland.

Of the three main buildings the largest, which will house the sintering machine and the raw material section, will be five stories high, 400 ft. long and 60 ft. wide. American Bridge Co.

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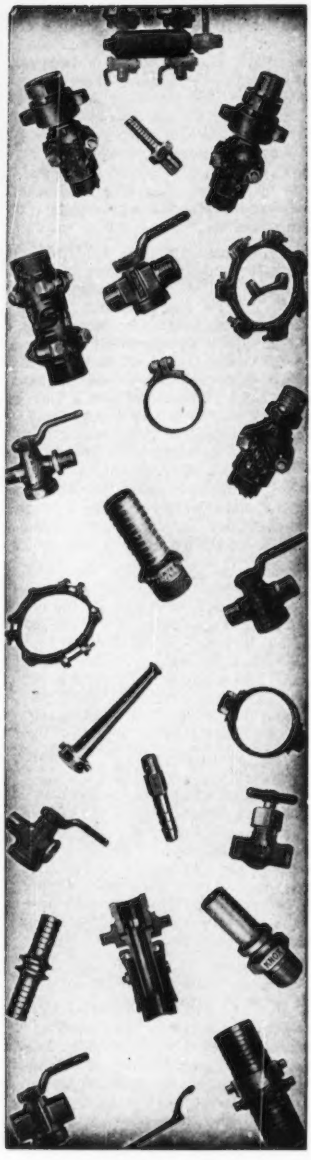

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will furnish the steel and erect it.

During the breaking-in period, and until taconite concentrates are available, fine ores and concentrates from many of Oliver's washing plants and open-pit mines will be brought to the Virginia plant by rail. Agglomeration will be done here.

Various methods of agglomerating have been tried by the industry, such as pelletizing, briquetting and sintering, but it is not yet known which one will be most economical and make the best product. (Pickands, Mather & Co. and Erie Mining Co. have been working on the problem of agglomerating taconite concentrate for several years at the big Erie pilot plant at Aurora, on the Mesabi). Oliver's new plant will experiment with nodulizing and sintering, in an effort to select a method for agglomerating taconite for a commercial plant.

In operation, fines will be separated by a vibrating screen and conveyed to ten 750-ton bins for agglomeration. Screen oversize will be loaded into cars for shipment. Taconite and fine concentrates from concentrators will be handled through the same bins.

Agglomeration of the screened fines will be done on a sintering machine 6 ft. wide and 96 ft. long. A rotary cooling bed 46 ft. in diameter will catch the sinter as it is discharged. After cooling slowly the sinter will be raked mechanically to a hopper for loading into railroad cars.

A somewhat similar product will be made in the nodulizing kiln which will produce egg-sized lumps. This brick-lined kiln, one of the largest in regular use, will be about 12 ft. in diameter and 350 ft. long. It will be fired with pulverized coal. The hot nodules, when discharged, will be cooled by an air-blast.

MICHIGAN

★An increase of 5c per hour for wage employees of the Calumet division of **Calumet & Hecla Consolidated Copper Co.** became effective on Feb. 27. Proportionate increases for salaried employees also became effective on that date. When operations were resumed last September, wages were reduced 15c per hour. The present increase is a partial restoration of the cut.

A decrease of $125,000 in the valuation of mining property in Houghton and Keweenaw Counties in the Michigan copper district has been recommended by Franklin G. Pardee, deputy state geologist and appraiser of mines for the Michigan Tax Commission. The matter will be reviewed at a public hearing soon.

While Mr. Pardee recommends reductions in the valuation of four properties and refined copper stocks in Houghton County, a $155,000 increase in Calumet & Hecla reclamations actually increases the total recommended valuations for Houghton County by $25,000.

ENGINEERING

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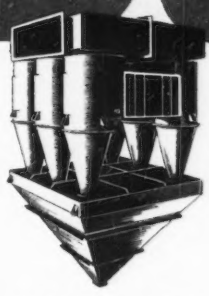
DUST



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NEVADA

★Ace Barton, well known Nevada mining man, has leased property at Divide, in western Nye County. During the first week of February, he shipped ten tons of gold ore to McGill. Owner of the property is Claude Pelando, of Tonopah. The ore is reported to have returned $128 per ton.

★Considerable shipments of gold ore from the **Tonopah Divide Mining Co.** property south of Tonopah was made last month by Charles Joseph, Louis Cirac and John Klaus, who are leasing it. The ore, said to be of fair shipping grade, came from the 300-ft. level of the mine. Another gold showing, with several hundred feet of backs, has been located on the 800-ft. level, and stoping is expected to get under way soon. Unlike silver ore, also mined on the property, the gold ore runs high in silica content which results in low smelting charges.

★Chicago interests have taken a bond and lease and made a down cash payment on claims owned by E. M. Booth in the Cimmaron district in western Nye County. Mr. Booth has done considerable development work on the ground and is said to have a good gold showing. Under terms of the contract, work will be started by April 1.

★Erection of a custom mill at Winnemucca to handle ores from nearby mines appeared as a possibility last month. Gus Rogers, manager of **Winnemucca Mountain Mines Co.,** reported he is well satisfied with the recovery of values from the ore on his property, and said he is now planning to erect a mill to treat the tonnage which he has available.

★L. F. Blake and his brother, Virginia City miners, have taken a contract to sink the first unit of the winze for **Uranium Production Co.,** on the Henneberg Property at Round Mountain, in Nye County. The winze will eventually be put down to a depth of 400 ft., according to W. J. Loring, of Tonopah, general manager. It was sunk to a depth of 30 ft. below the tunnel level last fall, and as soon as the weather moderates will be extended as a raise to the surface where a new surface plant will be installed.

★A report on the Union lead and zinc mine in Washoe County was issued this month describing extensions of the ore zones at the property established by a Bureau of Mines mineral investigation several months ago. The Bureau diamond drilled 21 holes totaling about 1,500 ft. and drilled 20 long percussion-drill holes aggregating almost 360 ft.

★**Getchell Mine Inc.,** has let a contract to Frank Maloney and associates, of Reno, to drive a tunnel cross-cutting the vein at the Bootstrap property.

★**Gold Mountain Mining and Milling Co.,** of Esmeralda County has signed a two-year lease on 12 claims, accord-

ing to Mrs. M. A. Brown, of Goldfield, secretary-treasurer of the company. The lessees are John J. Finch, of Goldfield, and Will P. McAllister, of New Mexico. The claims are located about 2 mi. east of Goldpoint, and have produced an estimated $100,000 in gold ore for previous owners. It has extensive underground workings, including five shafts varying in depth from 200 to 500 ft.

★Many of the miners who lost their jobs when the Cordero Mine in northern Humboldt County closed down Feb. 15 have now found employment with **Nevada-Massachusetts Co.** at Tungsten. The Nevada-Massachusetts tungsten operations in Pershing County are now in full production following a shut-down that lasted for several months of 1949.

NEW MEXICO

Great Lakes Carbon Co. has completed installation of 2,500 to 3,000-ton crushing and sizing plant at its perlite property near Socorro. By means of this plant the company is sizing four products for shipment to its eastern expanding plants. An intermediate drying process has been incorporated to remove minimum-sized material with a cyclone dust collector.

★**Pantheon Pumice Corp.** was formed in February at Albuquerque, with Dudley Cornell, a local attorney, as president.

★**Me-Tex Mining Co., Inc.**, has remodeled its plant at Antonio to process complex ores from its 62 claims in the Hansonburg district of central New Mexico. The plant will grind and sack 200 tons a day of barite, and will commence operations on jig concentrates from J. W. O'Brien's barite mill.

★The Kearney Mine of **Peru Mining Co.** resumed production of zinc-lead ores Feb. 17. The mine had been closed down since June 18, 1949. Miners returned to work at a base scale of $1.00 per hour, 35½c. lower than when the operation shut down. Head of Local 890, International Union of Mine, Mill and Smelter Workers, said the men were returning to work in a "trickle back" process, and that the union had refused to be a party to the wage cut.

OREGON

★Bonanza mercury mine, near Sutherlin, one of the most important domestic producers during World War II, closed down in December. It may never be reopened, even for a war emergency, according to F. W. Libbey, director of the State Department of Geology and Mineral Industries. The low mercury price and high operating costs caused the shutdown. Foreign imports were blamed for the low mercury price.

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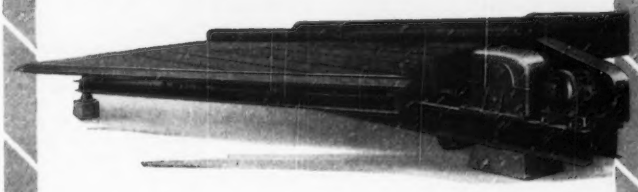

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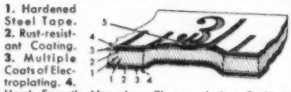

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Oregon *(Continued)*

★Leonard H. Gibbs, operating the South Slough mine in Coos County, has purchased an air compressor, two coal cutting machines, electric motors, pumps and other machinery, from the Southport mine which closed down in 1948.

TENNESSEE

★**American Zinc Co.** and the CIO Gas, Coke and Chemical Workers union have signed an 18-month contract agreement for employees at the Mascot and Jefferson City, Tenn., plants.

The new contract provides better seniority and leave of absence for all members and a 13½c. an hour wage increase for mechanical leaders.

TRI-STATE

★Latest development in the threatened mine cave-in at Picher, Okla., is a proposal to fill the mine with tailings, pumped in through drill holes. The **Eagle-Picher Co.** had discovered during a periodic examination that one of the large pillars in the Netta mine under the town was weakening. Drifts under the main street are 80 to 140 ft. high but no mining activities are being carried on there at the present time.

The company notified lease holders on Main St. in Picher of the impending danger. The Bank of Picher has already moved to a new site.

UTAH

★Attention in Utah mining circles has been centered, since mid-February, on the growing possibility of a sharp union struggle between the International Union of Mine, Mill and Smelter Workers and the rival CIO United Steelworkers of America. Mine-Mill, bargaining agency for some 2,500 men at **Kennecott Copper's** Bingham open-pit mine, the Tooele smelter and the Arthur and Magna mills was recently ousted from the CIO for allegedly following Communist policy.

As a result, in a telegram to the regional CIO director, Frank Bonnacci, top officials of the Congress of Industrial Organizations urged speedy efforts to organize Utah mine and smelter workers into the United Steelworkers of America. In 1949, thirteen UMMSW locals, chiefly in the Park City district, left the parent organization due to alleged Communist infiltration of their old union. Since then, eleven of these locals have joined the United Steelworkers, and the remaining two may follow suit shortly.

Al Skinner, regional director for

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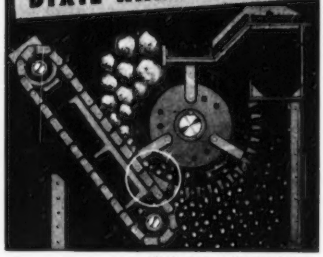

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the UMMSW, has asserted the action by the CIO constitutes an unwarranted raid. "This action proves the only reason for our expulsion was an attempt to raid our locals and take them into the steelworkers," Skinner stated.

"Our international union has been in business 56 years and we intend to stay in business," he added. Skinner pointed out that prior to January negotiations that resulted in new contracts between Kennecott and his union, five locals of the Kennecott council voted to remain in the UMMSW.

Bonacci, while stating that "no plan of action has as yet been mapped," indicated that the United Steelworkers will make every effort to organize the Utah mining industry. He released a message to regional leaders from Allan S. Haywood, vice president and director of organization for the CIO which read as follows:

"The Congress of Industrial Organizations directs the United Steelworkers of America to take in locals and members of the International Union of Mine, Mill and Smelter Workers. Act accordingly."

★An often discussed Park City diversion tunnel project has been delayed before the blueprint stage could be reached. E. O. Larson, Administrator for Region Four of the Bureau of Reclamation, stated that, since the plan is an integral unit of the Central Utah Project, it cannot be pushed until region-wide plans of his department are ready for Congressional approval—certainly not during the coming fiscal year.

★**Monsanto Chemical Co.** has taken an option to buy 3,200 acres of land in the Vernal region of Utah's Uintah Basin, where extensive phosphate deposits have been reported. Exploration and prospecting will be carried out over the next two years.

★Lengthy negotiations to work out contract agreements permitting the reopening of closed mines in the Park City district have again failed. George W. Haycock, staff representative of the United Steelworkers of America (CIO) announced (March 7) the union had turned down a proffered offer by the operators, and that a union counter-offer had likewise been rejected.

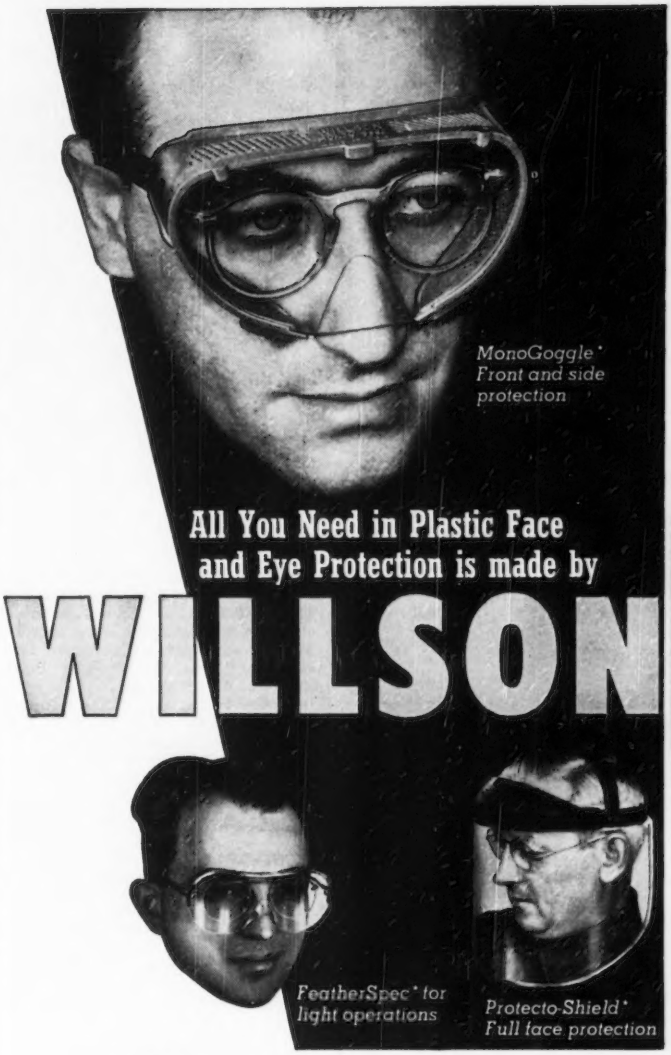
★Contracts calling for a 5c.-per-hour wage increase and promising a social insurance program have been signed with 1,200 employees of the **American Smelting and Refining Co.**'s Garfield Smelter.

Stipulations in the contract, retroactive to Dec. 16, 1949, and in effect until June 30, 1951, include:

Three weeks' vacation with pay for union employees having 20 years of continuous service.

Establishment of a joint labor-management safety council "to develop the most effective safety program possible."

Both labor and management agreed to "explore various social insurance



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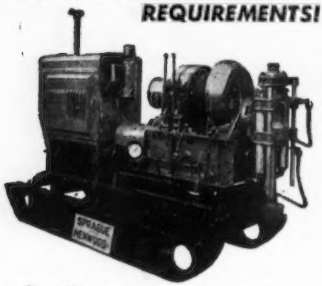

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Washington *(Continued)*

programs for employees and their families"

★**Aluminum Company of America** announced that new construction at its new rod mill in Vancouver would amount to about $300,000. The rod mill is expected to start operating this spring.

★**Pend Oreille Mines & Metals** is attempting to settle a wage dispute with a three-man conciliation board. Mediators are Chairman F. M. Clement of the University of British Columbia's Agricultural College, Major Gen. John P. Mackenzie, nominated by the Reeves company, and Harvey Murphey, representing the Union. Mr. Clement has proposed a pay increase to $9.50 starting in May with some differentials for employees other than those on basic miners' wages. Miners now receive $8.24 per shift plus a $1 cost-of-living adjustment granted in 1948. Mr. Murphey recommended a scale like that of the copper mines, Britannia and Granby. The copper scale would push the wage above $10.

★**Metaline Mining & Leasing Co.** has acquired the property of **Sterling Zinc-Lead Co.** which has 10 patented claims in the Metaline Mining district. Sterling stockholders will receive one share of Metaline for each three shares of Sterling held.

Ground through which the Metaline operates was owned by Sterling. The company is also negotiating for a lease of the Majestic group of six claims in the same area.

★**Grandview Mines, Inc.**, a leading lead-zinc producer, mined and milled a record 19,110 tons of ore in January, according to D. I. Hayes, western manager of **American Zinc, Lead and Smelting Co.** Grandview paid 2c. a share dividend. It received almost $45,000 from American Zinc-Lead in royalties for the fourth quarter of 1949. Newly-elected directors are E. K. Barnes, Spokane banker, and John H. Roberts, retired business man.

★E. H. Jamieson, manager of **Santa Fe Tungsten Syndicate**, Spokane, reports that a midwestern tungsten using company is interested in a vein of scheelite and wolframite which has been opened in Stevens County. The syndicate has a lease and option on 15 claims, 10 mi. northeast of Hunters, belonging to **Columbia Tungsten Corp.** According to Mr. Jamieson 1,800 tons of ore have been blocked out on an extension of the drift. A 300-lb sample from across the 5-ft. vein ran 2½% tungsten in a mill test. Plans are to open the present 100-ft. vein an additional 400 ft.

★**Washington Brick & Lime Co.** expects production to start late this spring at its new tunnel kiln at Dishman, says Neal R. Fosseen, president. The company reported a net income of $100,557 for the fiscal year ending last September, an increase from about 5% to 7½%.

★J. W. Lower and J. W. Geisbauer have reopened the old Turk and Togo copper-silver mines in the Deertrail district near Fruitland. They have built a 50-ton flotation mill and plan to start mining and milling this spring.

They will first mill the Turk dump which they estimate has 8,000 to 10,000 tons of ore averaging 4½% copper. The Togo vein will then be worked, raising on about 130 ft. of backs and sinking on the ore. Later a new shaft will be driven in the Turk.

★A $33,448 contract for constructing a mine-to-market road from Chesaw to Buckhorn Mountain iron mine, has been let to P. L. Saddler. The 5-mi. link will complete a 23-mi. road from Oroville to the mine.

★Work on **Pend Oreille Mines & Metals Co.'s** huge milling plant, shut down at the end of the year because of severe weather, was resumed in February. According to Jens Jensen, secretary-treasurer, the first 800-ton unit of the 2,400-ton mill, is expected to be completed late this summer.

IN CANADA

- Titanium Furnace May Operate This Summer
- Jurisdictional Strife at Trail

LABRADOR

★All signs point to 1950 as the busiest summer yet for the new Quebec-Labrador iron fields. Besides the verification work and new prospecting to be done by **Iron Ore Company of Canada**, further work will be done by **Labrador Mining & Exploration Co.** and **Hollinger North Shore Exploration Co.** After making the deal with IOCO, the two latter companies retain large areas of favorable ground

as well as 78 million of the 355 million tons of iron ore so far found. As the ore is in a large number of bodies strung out for 19 miles across the Quebec-Labrador boundary, the scope for new prospecting is immense.

QUEBEC

★The busiest exploration area in Canada this year will probably be **Chibougamau,** a hundred miles north of transcontinental steel, according to preliminary indications. More than 650 claims were staked during the winter months, and activities are expected to spread through many townships now that the new Provincial highway has given the area its long needed means of transportation.

★With operating profits in the neighborhood of $500,000 per month, **East Sullivan Mines** has established itself as a successful copper-zinc producer. The first dividend should be paid this year, perhaps in May. Ore reserves at the end of 1949 were slightly above the 4,372,000 tons reported at the end of 1948.

★**Lamaque Gold Mines,** subsidiary of **The Teck-Hughes,** showed net profits of 37c. per share in 1949, the best since the early war years. The mill averaged 1,382 tons daily for total tonnage of 504,350, highest in its history.

★Underground work has been resumed at the Beauchastel Twp. property of **Lake Wasa Mining Corp.,** where development prior to mid-1948 indicated 1.9 million tons of ore averaging slightly better than 0.15 oz. gold per ton. New finances were raised during the winter and the company plans to deepen the shaft to 1,000 ft., opening new levels at 800 and 1,000 ft. before making plans for production.

★One furnace of the five now contemplated at the Sorel titanium plant of **Quebec Iron and Titanium Corp.** should be in operation late this year. Construction of the wharf and smelter at Sorel is well underway, and much work has been done on the 27-mi. railway from the mine at Allard Lake to Havre St. Pierre on the St. Lawrence. The company, controlled by **Kennecott Copper Corp.** and **New Jersey Zinc Co.,** holds one of the world's major deposits of ilmenite, source of titanium. Initial objective is 250,000 tons of titanium dioxide and 175,000 tons of high-grade iron annually.

★Underground exploration at the **Beattie area** mine of **Consolidated Duquesne Mining Co.** is being speeded up, following electrification of the plant, with plans to search for additional ore both laterally and at depth. Meanwhile production is steady, 100 tons going daily to the mill of neighboring **Consolidated Beattie Mines.** From the start last June to the end of 1949

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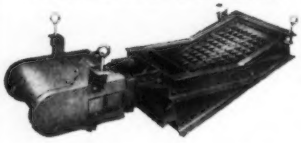

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Quebec *(Continued)*

gold output was $217,116 from 24,146 tons averaging $8.95 per ton.

ONTARIO

★First work on the new bottom 2,875-ft. level at **Leitch Gold Mines** in the Beardmore area has disclosed two orebodies typical of the mine in dimensions and grade. This is the first ore to be found below the 600-ft. diabase sill which cut off the ore at the 1,875-ft. horizon. With uncertainty thus removed regarding the existence of ore at depth, Leitch is in a fine position with possibly five year's supply of ore in sight above the sill, as well as the new disclosures below it. Profitwise the company is doing well too, 1949 having been the best production year in its history. Gold output was $1,002,302 from 31,885 tons.

★**Upper Canada Mines** is considering a mill increase, probably to 750 tons daily from the current 400 tons. This veteran Larder Lake Producer estimates the new B orezone to contain more than 1.5 million tons averaging around $8. Drilling has traced the new ore from the 625 to the 1,725-ft. horizon, and excellent results have been had in lateral work at the 1,000 and 1,125-ft. levels. Further interest is focussed on the sinking of a new shaft on the Eastward section of the property, and also on the new development program at **Queenston Gold Mines**, adjoining. Inactive several years, Queenston has been revived by strong injections of new capital.

★**Matachewan Consolidated Mines** has started development on its new bottom level at 2,280 ft., first lateral work to be done below the former bottom at 1,850 ft. Exploration is also in hand on two outside projects. Jointly with **Ventures Ltd.** the company has secured 72% control of **British Matachewan Gold Mines**, adjoining, and surface drilling is planned for the coming summer.

★First work on the 2,050-ft. level at **Kerr-Addison Gold Mines** in Larder Lake has shown fine results, with three orebodies averaging $16 over impressive widths. Net earnings in 1949 were 81.4c. per share, well above dividend needs of 60c. and sufficient to add more than $1 million to working capital.

★New life has been given to the Little Long Lac camp by the important developments at MacLeod-Cockshutt Gold Mines, where the big "F" zone has virtually given the company a new mine. First disclosed on the 10th level where 1,500 ft. of length, with both ends open, showed volume of 6,000 tons per vertical ft., the ore has been picked up by drilling on the 7th, 8th, 9th, and 11th levels. Grade won't be known until extensive milling tests have been made, but $5 to $7 per ton is anticipated. Observers

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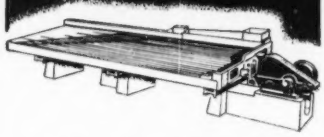

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believe the new ore will permit mill expansion to 1,500 or 2,000 tons daily.

★**Lake Shore Mines,** already the deepest mine in North America, plans further deepening of the main internal shaft from 7,613, ft. to 8,000 ft. The company's annual report for 1949, in addition to showing net profits of 84c. per share, the best since 1943, stated that depth exploration will be pressed but added that the levels above 4,000 ft. can be expected to produce important ore for many years to come.

★**Macassa Mines** and its subsidiary **Renabie Mines** both made good progress in 1949, with improved production and earnings, Renabie earned 16c. compared with 6.15c. per share in 1948, while Macassa raised its net from 9.8c. to 15.7c per share. Renabie was accordingly able to reduce its debt to Macassa by $349,000.

MANITOBA

★**Sherritt Gordon Mines Ltd.** reports that a diamond drilling program will be carried out on its holdings in the Oxford Lake area. Geographical work has indicated four anomalies in the vicinity of Nature Island.

★At **Sherritt's** Lynn Lake property, the drive to the "B" orebody on the 1,000-ft. level is continuing. The 120-mi. winter road connecting Sherridon and Lynn Lake has been widened out to permit transport of all buildings except the largest ones from Sherridon to the new townsite at Lynn Lake.

★**Ogama-Rockland Gold Mines** reports the output of bullion for 1949 at $573,973 compared with $341,656 in the preceding year. Tonnage and grade were respectively 49,208 and $11.66 in 1949 and 27,546 and $12.40 in 1948.

BRITISH COLUMBIA

★For the thirteenth consecutive year **Bralorne Mines, Ltd.** last year was leading gold producer in B.C. with value of output about $3,000,000, exclusive of assistance under the Emergency Gold Mining Assistance Act. Again in second place was **Kelowna Exploration Co., Ltd.,** with its Nickel Plate producing $1,650,000. **Polaris-Taku** continues third with production for the year values at slightly under $1,200,000. Pioneer Gold Mines., Ltd., was in fourth place with a value of about $1,150,000.

★A union contract has been signed by **Highland-Bell, Ltd.** with the International Union of Mine, Mill and Smelter Workers, Local 900, representing employees at the company's Beaverdell silver mine. The contract, first collective agreement in effect, provides for a labor-management committee on production problems; a basic wage of $8.25 per day plus an interim

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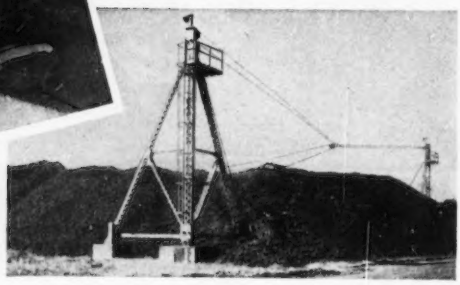

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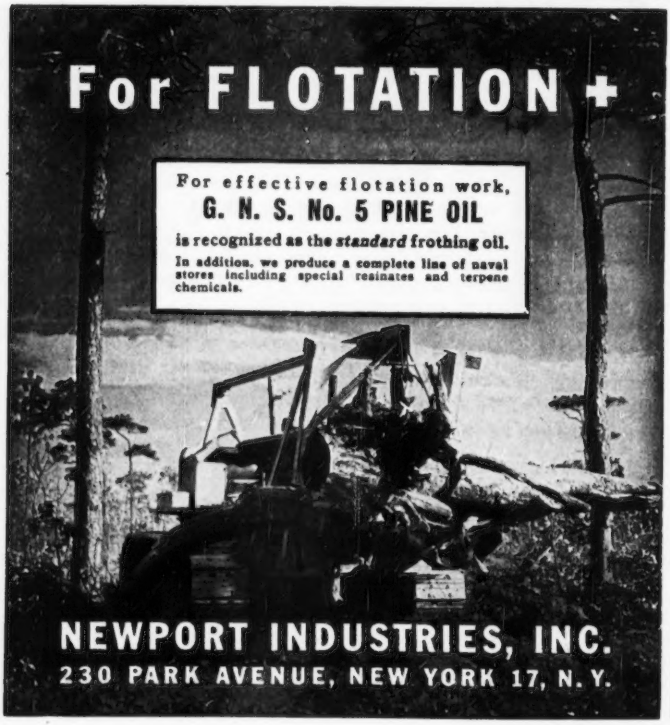
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British Columbia *(Continued)*

wage adjustment of 25c. per shift (a 25c.-per-shift bonus is paid at present, but is subject to termination) bringing total wages to $8.51 per shift. A premium of 3c. is paid for the afternoon shift. The company has agreed to continue its holiday system whereby an annual vacation is provided starting July 1 each year, with employees of one year's service totaling 250 days' work in the year getting nine days; employees of two years service, 12 days, and with four years, 14 days. Time and a half will be paid for five statutory holidays, if worked, and double time for Christmas Day. Contract runs for one year from Nov. 1, 1949.

★Principal development work on the McGillivray Falls property of **Golden Contact Mines, Ltd.** will be concentrated on the driving of a new low-level tunnel, at an elevation of 2,918 ft, 269 ft below the 49 level, lowest developed horizon to date. Early opening of as many development faces as possible is felt to be of more importance than construction of a 25-ton mill, considered since the close of the 1949 season.

★**Jersey Lead-Zinc** (Emerald) mill of **Canadian Exploration, Ltd.** handled 18,072 tons in the three months ended Dec. 31. Ore averaged 2.25% lead and 5.08% zinc and produced 2,086 tons of concentrates from which the net smelter returns amounted to about $164,000. The mill was closed for 25 days in January and six days in February for repairs, alterations and additions, including overhaul of the aerial tramway.

★**Island Mountain Mines Co., Ltd.**, Cariboo district, reports better than average gold output for the first month of 1950. Production for January was 1,643 fine oz. gold from 3,888 tons for an average of 0.42 oz. gold per ton. Value at $38.50 per oz. was $63,245.

★**Consolidated Mining & Smelting Co.'s Trail** plant is producing heavy water—and heavy hydrogen—in small quantities, but it's for use at the Chalk River, Ont., atomic pilot plant as a moderating factor in the radioactive pile, and there's no "tremendous backlog" being built up for use in hydrogen bombs.

★The issue of Communist leadership has resulted in a bitter jurisdictional war at Trail involving 2,900 workers at **Consolidated Mining & Smelting Company of Canada.** United Steelworkers of America (CIO-CCL) is seeking to take over the membership and jurisdiction of the International Union of Mine, Mill and Smelter Workers which was suspended indefinitely last October by the Canadian Congress of Labor because of alleged leftist leadership.

Mine Mill Local 480 was left without elected officers recently when top executives went over to the CCL steel-

workers and the local was put under administration of IUMMSW Representative John Gordon. The dispute moved into the courts when IUMMSW started suit asking an injunction prohibiting use of 1,700 membership cards by the steelworkers' local on an application to the Labor Relations Board to be designated as bargaining agent with CM&S, and a further court order prohibiting the new local from using the name, "Trail & District Smelter Workers' Union." Decision has been reserved by B.C. Supreme Court Justice Whittaker.

★**Britannia Mining & Smelting Co.** mine on Howe Sound, which has produced more than 775,000,000 lb. of copper over the past 40 years, is being developed along a new line, with the discovery of a new orebody low in copper and gold, but containing values in zinc, with some silver. **Howe Sound Co.**, owners, in the annual report for 1949, report the orebody was developed during the year in the upper section of the mine and that the discovery has made it advisable to continue exploratory work at the same horizon to the west where zinc mineralization is known to exist. Development of lower levels of the mine in the No. 8 area was continued with satisfactory results. Howe Sound earned $3.67 per share in 1949, compared with $6.16 in 1948, the drop reflecting the decline in metal prices. Total production of Britannia-Howe Sound properties for the year was 30,747,935 lb. of copper, 27,171,399 lb. of lead, 44,633,879 lb. of zinc, 1,323,884 oz. silver and 94,749 oz. gold. Net income for the year after provision for taxes was $1,794,024.

★**Kyack Copper Mines, Ltd.**, will carry out an exploration program on the Davidson claims in the Pender Harbor, Salt Spring Island, area, in the Gulf of Georgia. The property comprises seven claims held as a copper prospect. Metallurgical tests are planned on bulk samples. This is the second exploration program announced for this area this year. Recently **Caron Mining Co., Ltd.**, announced tonnage possibilities of the Cambrian Chieftain property would be tested.

YUKON

★**Yukon Consolidated Gold Corp., Ltd.**, operating in Klondike district, near Dawson, has sufficient ground thawed and stripped for a full season's work in 1950 for each of its eight dredges, assuring work for 450 men. A new labor agreement leaves the basic wage scale unchanged, but provides a cost of living bonus of $1.50 per shift to married employees and a flat seasonal allowance of $100 to each employee for transportation. Compared with a loss of $17,582 in 1948 after $252,394 for writeoffs, the annual report for 1949 shows an estimated profit of $432,822 after $257,361 for writeoffs.

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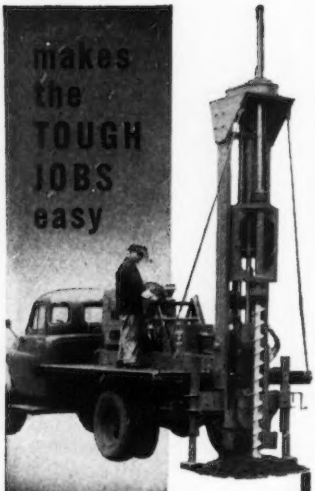

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Yukon *(Continued)*

Total value of production in 1949 was $2,173,450, including the premium from the devaluation of Canadian currency in the latter part of the year, compared with $1,675,751 the previous year.

★**Reno Gold Mines, Ltd.**, has negotiations under way for sufficient capital to equip its placer property on Canadian Creek and put it into production. Experimental operations last season gave satisfactory results, with installation of a new Denver jig and amalgamation barrel to treat concentrates from the sluice box allowing a saving of 50% in gold. Good savings were also made in tungsten. Positive reserves total 1,577,000 yd, with 2,790,000 yd of probable gravel.

IN LATIN AMERICA

MEXICO

★**Insufficient capital,** outmoded machinery, and inadequate power supply and communications facilities were cited recently in a report of the Bank of Mexico as the major current handicaps of Mexico's mining industry. The report, prepared by Ing. Adrian Esteve, called for a sweeping program of modernization of existing plants, exploration for new orebodies, building of access roads, improved rail transport, custom mills and smelters for small miners, development of new industries in Mexico that would use the products of Mexico's mines. Sr. Esteve urged a halt to export of Mexico's iron ore. With reserves of about 300,000,000 tons, Mexico cannot afford to export more of this vital industrial material, he claims.

★**A brighter future for Mexican silver** was forecast by Lic. Carlos Novoa, director general of the Bank of Mexico, in announcing that Great Britain, Saudi Arabia, Belgium, Syria, and Lybia are negotiating silver purchases with Mexico. He said that practically all such orders, presumably for minting abroad, would have to be filled from current mine output. The Bank isn't buying silver at present, and will use its stocks to supply the Mexican mint.

★Prompt attention to **a petition for tax relief** to mining enterprises was promised by President Aleman recently to Lic. Jose Aguilar y Maya, governor of Guanajuato. The Governor had visited President Aleman in Mexico City to point out the urgent need for new capital to keep mining going in Guanajuato. Tax relief was suggested as one means to get new money into mining there.

BOLIVIA

★**Mineral production of Bolivia** in 1949, with a comparison with 1948, was as follows:

	1949 metric tons fine content	1948 metric tons fine content
Tin	34,647	37,935
Lead	26,374	25,610
Antimony	10,283	12,260
Zinc	17,667	21,124
Copper	5,073	6,616
Tungsten (WO_3)	1,542	1,491
Silver	206	235

Except for small amounts of pig tin and tin solder produced in the Oruro smelter, all this production was exported in the form of concentrates. Small amounts of sulphur, gold, asbestos, bismuth, and fluorite were also exported.

★**Tin production** fell somewhat in 1949, owing mainly to the price decline that began late in the year. On the other hand, **lead output** set a new record for Bolivia in 1949, despite the severe drop in the lead price last year. Most of this lead came from expanded plant capacity set up in 1948.

★On February 25, the Bolivian government issued **two decrees of direct interest** to the country's mining industry. Up to that date, tin producers were forced to sell about 58.5% of the price in dollars of their tin output to the Bolivian government at a rate of 42 bolivianos to the dollar. The so-called official free rate was Bs. 115 to the dollar. The black market rate had gone to Bs. 142 to the dollar. The Banco Central sold part of these tin dollars at Bs. 42 and part at Bs. 56 for imports.

Under the two decrees of February 25, tin producers still have to sell about 58.5% of their tin dollars to the government, but the rate goes up to Bs. 60 per dollar. Banco Central will then supply dollars at Bs. 42 for essential imports like wheat, sugar, beef, rice and vegetable oils. For other imports and expenses, the Bank will use a rate of Bs. 60 for Bs. 100. The "free" rate has been cut to Bs. 100.

The objective of these moves is to help the tin industry, which has been seriously hurt by the recent 30% decline in the price of tin. Also, it is apparently a step toward increasing the country's food imports.

Mining circles believe, however, that unless fundamental measures are taken before long to increase mine production and to aid mine development, whatever advantage the new exchange rate gives mining will soon disappear. Local prices and wages are bound to increase in terms of Bolivian currency, and the inflationary spiral will make another spin.

CHILE

★On February 17, the first shipload of **Chilean oil** from Springhill was pumped aboard a tanker owned by a

Uruguayan company, acting for a government agency. The Springhill field is owned and operated by the Chilean **Corporacion de Fomento.** So far, 29 holes have been drilled, of which 12 are producing oil, 9 gas, and 7 nothing. Daily output of the field is 1,800 bbl. The gas escaping is being burnt for lack of a use for it.

★The Chilean government is studying various ways of increasing the appropriation for the Mining Bank. Purpose is to increase ore purchases. The recent **increase in the price of gold** owing to devaluation, has brought a flood of would-be sellers of gold ore to the Bank's mills.

★**The Placer deposit** found recently in Cautin Province, yielded 320 oz. of gold almost at once, then seems to have dwindled rapidly. Production has failed to come up to expectations.

★**Cia. Minera Aysen** is exporting high grade galena ore (60% lead) to Buenos Aires. The buyer is a subsidiary of Penarroya, a French company that owns mines principally in Spain. Aysen expects to start its 60-ton lead-zinc flotation mill next May. Because the mine is so remote, and the roads to it so bad, construction costs have been quite high. The ore is, however, very high grade. (For a description of the Aysen orebody, se *E&MJ*, April, 1948, p. 93.)

★**Cia. Minera Merceditas** has bought the copper mine and mill of Cia. Minera El Volcan, and is operating it. Capacity of the mill is 80 tons daily. It is located about 30 miles east of Santiago in the Maipo Valley.

★**Cia. Minera Los Amigos** is operating its new 40-ton copper mill at Tiltil near Santiago. It was built on a loan from the Mining Bank.

COLOMBIA

★**Gold output in 1949** reached 11,984,-387.38 grams for a value of $13,347,-866.66. This is an increase over 1948 of $801,262.45. The Government thinks that actual output was quite a bit higher still, but that a good deal of gold got out of the country unrecorded. Smugglers are doing a good business in exporting gold and bringing in luxury goods for which no import licenses can be obtained.

★**Uranium deposits** have been located in Santander and Bolivar Departments in northern Colombia, according to Dr. Elias del Hierro, minister of mining and petroleum. Having no legislation covering mining of uranium, the country is holding these areas in reserve until suitable regulations can be worked out. The laws covering mining of uranium in the United States are being studied as a model.

★An European company, name unknown, is looking for **manganese and beryllium** in Colombia. It is said the company has around $3,000,000 to invest.

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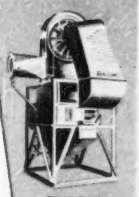

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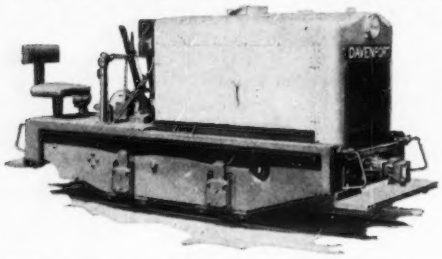

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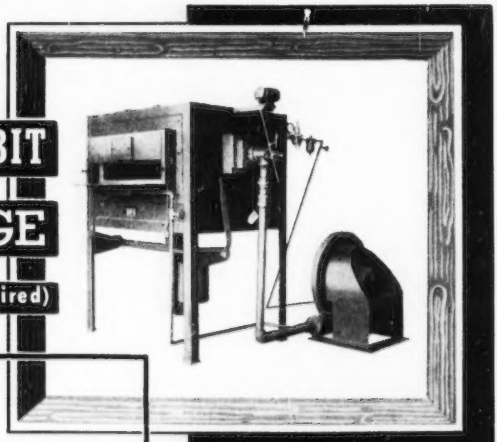

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IN EUROPE

SWEDEN

★**An ECA loan of $350,000** has been granted **A. B. Zinkgruvor, Falun,** to buy mine equipment. By modernization and expansion of operations at four of the company's mines in the Garpenberg field, output of zinc, lead, and copper ore is to be raised from 50,000 to 250,000 tons a year.

Repayment of the loan is to be made in zinc and lead, starting in 1952 Actual shipments will depend on New York market prices, and the amount of the loan used. The company is first seeing what can be obtained in Europe, before deciding on the equipment to be purchased in the United States.

The largest mine contains 8-10 million tons of extractable ore, with a zinc content of 5.3%, lead 3.5%. Workings are among the oldest in northern Europe, dating back over 500 years. Recent exploratory work on the orebody, carried out by Zinkgruvor, was exceptionally troublesome, involving draining part of the nearby Gruvsjön Lake.

Zinkgruvor's expansion program includes construction of a concentration plant, in stages extending over five years. Even if the whole loan is used, repayment shipments will only run to a fraction of the total metal output. Valuation will be at current New York prices, less duty and freight.

★**AB Dannemora Gruvor** is also modernizing extensively, principally by addition of a concentration plant. This means that large quantities of low grade ore, which have previously been dumped, can be put to use. The beneficiating plant's capacity will be 50,000 tons of concentrate a year. Most of the machinery has already been purchased, but the plant will take three years to construct. Dannemora mines at present yield about 80,000 tons of usable lump ore, mostly with an Fe content approaching 50% and 3.8% Mn. Small quantities of the ore contain up to 16% Mn, however.

★**A new mine** is being opened by the **Stora Kopparberg** company at Blötberget, near Ludvika. Output of 200,000 tons of iron concentrate will go to the company's steelworks at Domnarvet, where capacity is being raised from 200,000 to 400,000 tons of raw steel per year. Further reserves have been acquired by the purchase of an adjoining mine from Bergsverks AB Vulcanus. Ore from both mines will be taken up via the new shaft to the concentration plant. Primary crushing takes place at the 900-ft. level, with Margardshammar (Swedish) equipment.

★**A prospecting shaft** has been sunk at Haggruvan in the Garpenberg district to a depth of 600 ft. Behind the project are three Swedish steelworks, **Hofors, Sandviken, and Fager-**

sta. Magnetic prospecting indicates considerable bodies of iron ore.

IN AFRICA

★**Free State Geduld Mines, Ltd.,** has yielded to the temptation to get right down and see what there is in the Basal Reef at the spot that gave them the richest core ever drawn from a Free State borehole. This was the fabulous, and famous, Geduld No. 1, which caused tremendous buying surges in Free State stocks in exchanges all over the world some time ago. Value of the core was calculated at 23,037 in-dwts. The company has decided to issue 3,000,000 shares (at 5s), which have thus far been held in reserve. At the same time the company decided to stop work in its No. 2 shaft at 4,200 ft., 1,200 ft. above the Basal Reef, and concentrate on underground development to make contact with the rich borehole on the Reef. This development will, however, be off reef until it connects with development from Western Holdings No. 1 shaft at the boundary between the two companies.

★Sales of **gold at a premium** "for industrial and artistic purposes" last year brought in an extra £1,066,286 for South African gold miners. Most of this came in during the last quarter of 1949.

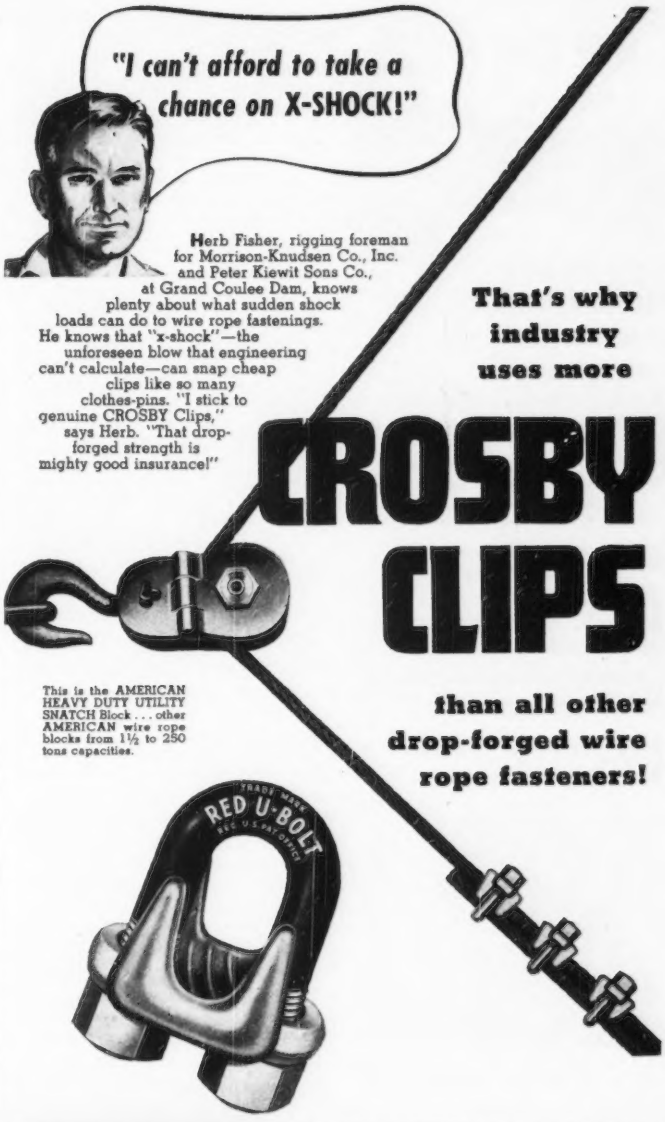
★**Ore reserves** of the Rand's gold mines were up as much as 30% at the year's end as a result of revaluation of ore reserves growing out of the recent devaluation of the pound.

★Some of the Rand's mines earned **substantial profits** in the last quarter of 1949. East Daggafontein, in the Anglo-American group, earned a working profit of £1,589,528. East Geduld, in the Union Corporation Group, earned £1,160,606. Income from premium sales of gold, mentioned in the preceding paragraph, was in addition to profits such as these.

★**Shaft sinking** in the Orange Free State field was held up in recent months by intersection with water-bearing fissures. Considerable time and cement has been used up in getting past these barriers. The following paragraphs give the current status of the various shaft-sinking programs.

At Welkom Gold Mines, the crew expects to cut the Basal Reef in March or early April. No. 1 shaft had about 300 ft. to go, and No. 2 shaft, 400 ft. The company planned to stop No. 2 shaft at 3,050 ft. and drive over to No. 1 for development purposes. Production should begin sometime in 1951, barring further delays of some sort.

At St. Helena Gold Mine, development work went on along four levels north and south of the No. 3 shaft. This is the incline shaft sunk by St. Helena to pick up the sub-outcrop of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Africa *(Continued)*

the Reef. Total footage developed was 5,203 ft., of which 1,270 ft. on Basal Reef were sampled. Of this, 560 ft. were found to be payable, with an average value of 14.8 dwt. over 13 in. Heavy water flows are hampering development.

At President Steyn Gold Mine, No. 1 shaft is down past 1,000 ft., having cut coal seams and carbonaceous shale between 987 ft. and 1,000 ft. No. 2 shaft was down beyond 500 ft. in the blue Karroo shales.

At President Brand Gold Mine, No. 2 shaft was collared, and the No. 1 shaft was nearing 200 ft.

At Free State Geduld, No. 1 shaft was down over 1,000 ft. and No. 2 was nearing 2,000 ft. Progress had been held up by water flows.

At Freddies North Lease Area, good progress was made, with No. 1 shaft down over 2,500 ft. and No. 2 down nearly to 2,000 ft. Capital expenditure during the last quarter of 1949 totaled £209,908.

At Freddies South Lease Area, No. 1 shaft was beyond 1,500 ft. and No. 2 shaft was below 2,000 ft. Capital expenditure during the last quarter was £190,591.

★**Capital expenditures** for all Rand mines during the last quarter of 1949 came to around £3,000,000. This went mostly for shaft sinking and new equipment.

★**Sales of antimony** brought in £119,266 for Consolidated Murchison Goldfields & Development Co. during the last quarter of 1949. Revenue from gold came to £22,012. Working profit totaled £48,099, but there had yet to be paid about £5,600 to the Government in taxes. The company reports finding new antimony orebodies of a grade higher than any yet mined.

★**The first concrete headframe** used by a South African gold mine is going up at the Margaret shaft of the Stilfontein Gold Mining Co. at Klerksdorp in the western Transvaal. It will be 145 ft. high, and is designed to take six 10-ton skips.

PHILIPPINES

★Gold mining companies have been selling 75% of their bullion on the Manila open market at more than 116 pesos per ounce. That used to equal $58 before exchange controls took effect. The other 25% of their gold output has to be sold to the Philippine Government the statutory price of 70 pesos. Actually the open market price of gold is substantially less than $58. It must mean that the canny Filipinos prefer gold to pesos, or even dollars. They fear devaluation of their currency. The present price of 116 pesos compares with the pre-exchange-control price of 86 pesos.

★Another significant development has

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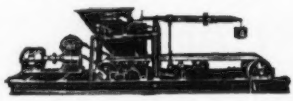

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been the sale of gold bullion on the local market in a more or less cooperative spirit. Practically all the major gold producers have banded together in a pool to get the best gold price possible. Base metal producers like Lepanto, have been granted a delay of four months in delivering the 25% quota of gold to the Government. This allows time for processing their concentrates elsewhere, usually in the States.

★**Surigao Consolidated** had an operating cost of about $9.75 per ton in 1949, and made a good profit on its present grade of ore. The 400-ft. level provides about 75% of current output. The Genperle shaft is rapidly approaching the 500-ft. level, where the management hopes the grade of ore will be even better than on the 400-ft. level.

★**Mindanao Mother Lode** produced $178,000 in January from milling 9,500 tons of ore. The high grade shoot on the 850 level is already 150-ft. longer than expected.

★**Benguet Consolidated** has stepped up its milling rate to 2,400 tons daily. J. M. Haussermann, president of the company, returned to Manila to make a personal inspection of the mine. He also conferred with Government officials to try to devise measures for further expansion of the gold mining industry.

IN AUSTRALIA

WESTERN AUSTRALIA

★**Neither production figures** for October and November, 1949, nor gold receipts at the Perth Royal Mint during January give an indication of an early upswing in gold production as a result of last September's devaluation of the Australian pound.

Australian production for October was 76,153 oz., compared with 74,016 oz. the same month a year earlier; and November production was 80,547 oz., compared with 78,094 oz. in 1948. However, the industry beat 1948's output in the first half of 1949, when there was no exchange incentive. Production was 453,062 oz., contrasting with 403,415 oz. during the first half of 1948.

In January, 51,444 oz. of gold produced in Western Australia went to the Perth branch of the Royal Mint. This compares with 50,869 oz. in January, 1949, and 54,829 oz. in January, 1948.

★**Production on the Golden Mile** has been mildly dislocated by a cold war between contract miners and mine managements. Contract miners, who comprise about 86% of the underground workers, demand adjustment of contract rates to keep them abreast of wage increases which have been granted to shift workers since 1939,

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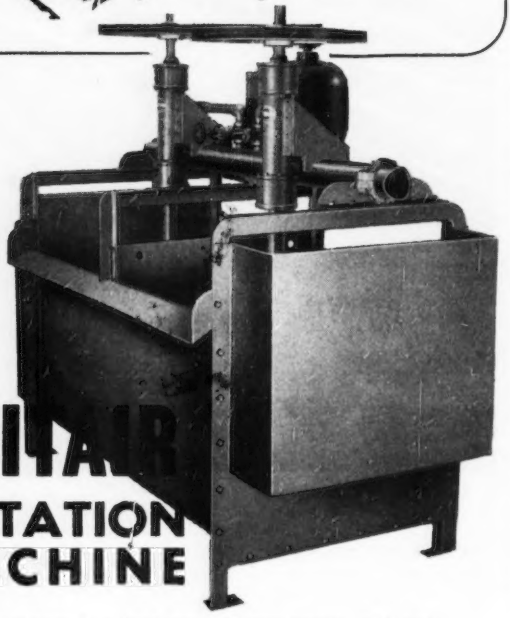

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Western Australia *(Continued)*

including the recently increased gold price bonus, and "freezing" of the price of explosives supplied by the companies.

★Because of the sound practice of developing ore several years ahead of the mill, the major gold mines **have built up reserves** of more than 10,000,000 tons, equivalent to nearly five years' mill consumption at present rates, reports the *Kalgoorlie Miner*.

The practice of developing reserves to a volume which represents several years' mill supply, against the South African system of limiting reserves to a year's requirements, is of great assistance to investors and gives the industry in Western Australia a stability which cannot often be associated with gold mining elsewhere, the paper says.

★**Mining of lead ore**, which returned only 22.36 tons in 1947, is fast becoming an industry of some importance. The most active area is the coastal strip stretching from Geraldton to Derby. The orebodies are typically short and rich and have not been worked to depths of more than 500 ft. They present excellent opportunities for the small operator, according to the Under Secretary of Mines, Mr. A. H. Telfer.

★**The Anglo Westralian Mining Pty. Ltd.** has acquired an option over a lead deposit at Ragged Hills in the Braeside district, east of Marble Bar. The company has also been granted tin dredging claims in the vicinity, and it holds a lease on a tungsten deposit west of Cue. There is already a concentrating plant for lead ore in the Braeside field.

NORTHERN TERRITORY

★**Princess Royal Gold Mining Co. Ltd.** has accepted an option to purchase the Black Angel-White Devil group of leases comprising 60 acres on the Tennant Creek goldfield. The leases are believed by Mr. M. R. McKeown, well-known consultant, to form an attractive exploratory proposition. They have a satisfactory record of production and geological evidence points to the extension of known ore shoots and the existence of new shoots.

TASMANIA

★**King Island Scheelite (1947) Ltd.** earned a profit of £63,764 for the year ended October 31, 1949, contrasting with £78,731 in 1947-48. In both years profit is shown after providing £30,000 for depreciation. The reduction was due to the decline in the wolfram price between 1947 and 1949. The company sold 862 tons of scheelite concentrates, compared with 525 tons a year earlier. Installation of two

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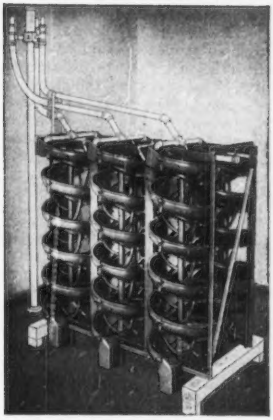

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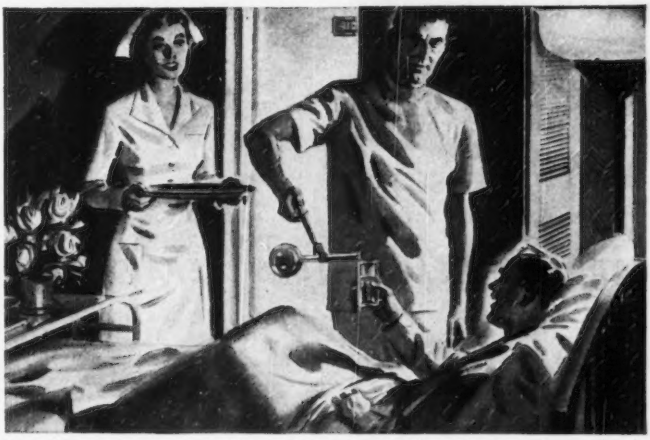
Atom pile by-products "fly" to help medical research



Radioisotopes were needed by a Boston hospital for patient treatment. Lead-shielded box of radioactive iodine (weight, 35 lbs.) picked up by Air Express in Knoxville, Tenn., at 11 A.M., delivered 7:15 P.M. Charge, $8.60. Hospitals, like all business, use Air Express regularly to get supplies from anywhere in hours.

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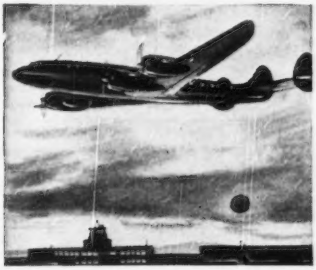

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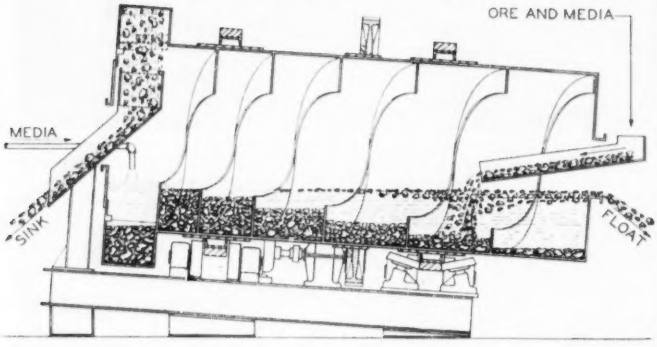
HARDINGE HEAVY-MEDIA* SEPARATORS



... With "Counter-Current" Action
—PROVEN ON THE IRON RANGE—

The Hardinge Counter-Current Heavy-Media Separator is a new separating device now in successful operation on the Mesabi Iron Range. It is a slowly-revolving, inclined, cylindrical drum with spiral flights attached to the inner surface of the cylinder. The material to be separated, accompanied by heavy media, is fed in at the lower end. As the drum rotates, the "sink" is carried by the spiral flights to the high end. The "float" overflows a circular weir at the lower end.

This simple but effective device has no internal moving parts to grind against each other. Thus, maintenance is extremely low. The quantity of media to fill this circuit is considerably less than with a cone of equal capacity. The separator will handle large pieces of ore—up to 4 inches. It can act as a medium reservoir and will start up easily after several hours shut-down.

Data collected during a typical run of a 7' x 16' Heavy-Media Separator on iron ore at less than maximum capacity: Size of feed, minus 4", plus ¼"; specific gravity of medium, 3.20; "Sink" produced, 200 tons per hour (dry); "Float," 75 tons per hour (dry); H.P. required, 9.2.

Write for Bulletin 39-B-1.

*The Heavy-Media Separation Processes are licensed by the American Zinc, Lead and Smelting Company, American Cyanamid Company, 30 Rockefeller Plaza, New York 20, N. Y., are their sole technical and sales representatives for these processes.

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COMPANY INCORPORATED
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NEW YORK 17—122 E. 42nd St. • 205 W. Wacker Drive—CHICAGO 6
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Tasmania *(Continued)*

hammer screens was completed last August. Performance of these screens has exceeded expectations, the managing director, Mr. A. R. Bruhn, states in the annual report to shareholders. They have caused a substantial reduction in slime production and have lifted mill recovery rate of sale-grade scheelite. Test work on the flotation plant product was also successful. Rearrangement of the fine grinding section of the mill is being undertaken to raise the secondary crushing rates of throughput. Ore reserves at October 31 were estimated at 2,789,999 tons.

★**Mount Lyell Mining & Railway Co. Ltd.** treated 373,532 tons of ore for 7,892 tons of copper concentrates during the last quarter of 1949. In the period, 11,331 tons of concentrates were smelted for 2,737 tons of blister copper, containing 2,715 tons of copper, 9,300 oz. of silver and 1,728 oz. of gold. Cathode copper produced during the term totaled 1,671 tons.

NEW SOUTH WALES

★Although **Lake George Mining Corporation,** Captain's Flat, was in full operation for only 67 days last year, the mine realized a consolidated profit of £324,843 sterling. Operations were suspended for nine months because of a "bonus" strike at the mine, followed by a general coal strike in New South Wales. The high profit was due to a large carry-over of concentrates which was sold at peak market prices. The costs of keeping the mine unwatered and meeting other maintenance charges were about £11,000 a month while the mine and mill were closed down.

★Encouraged by the increase in the Australian gold price, **New Occidental Gold Mines, N. L.,** Chesney and New Cobar, is planning to invest up to £4-million in a major development program for an annual return of £1-million at current prices.

However, a drilling program extending over three years and costing £100,000 is anticipated before a final decision can be taken, while development and construction would take another five to six years.

Production from present reserves will be continued without further development at depth. It is expected that the Occidental mine could produce 100,000 tons a year for 2½ years and the Chesney mine 50,000 tons for 1½ years. If diamond drilling is successful, ore production of 1,000,000 tons a year is contemplated. This ore would average 0.9% recoverable copper and 1.9 dwt. gold. The company's three main orebodies would be connected to one haulage shaft and all ore would be treated at one mill. Production would be 90,000 to 95,000 oz. of gold and 9,000 tons of copper a year.

Twin 500-barrel Hiboy Bolted Steel Tanks with Safwalk Walkway

ECONOMICAL STORAGE *for Your Liquids*

• On-the-site storage of liquids is no longer a problem. BS&B Tanks can go wherever you can go. Bolted Steel or Durable Wood, when knocked down, is only a truck load. Many times they have been flown in to a new operation.

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They're soundly engineered for long, long life. Weatherproof and tight as a bottle. Even inexperienced labor can erect them quickly. Many sizes available from stock. EXPORT SHIPMENTS A SPECIALTY.

Handsome, all-Redwood 500-barrel Durable Wood Tank

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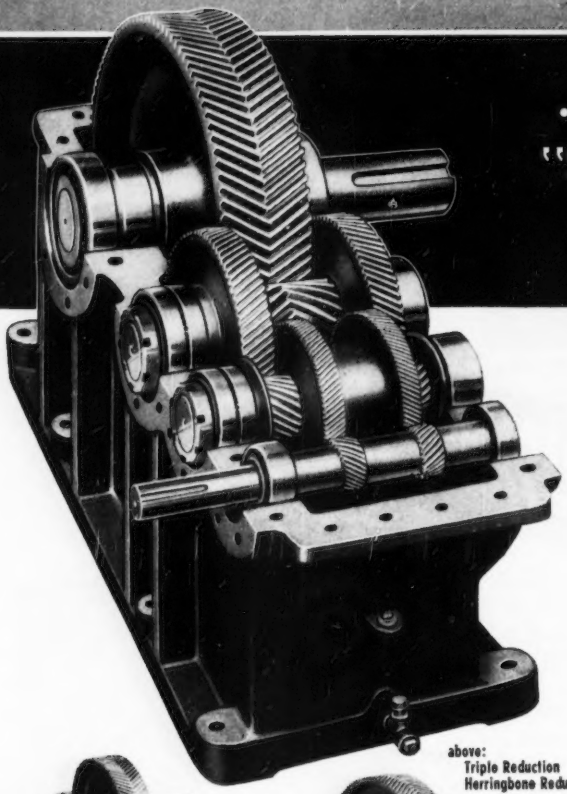
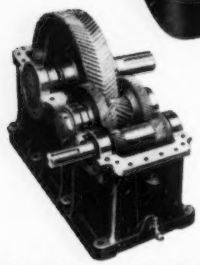
THIS GEAR ARRANGEMENT
GIVES PERFECT BALANCE & SYMMETRY

. . and Bearings "Share the Load" *Equally*



above: Triple Reduction Herringbone Reducer



Double Reduction Herringbone Reducer

Single Reduction Herringbone Reducer

..another feature of

Philadelphia
HERRINGBONE
Speed Reducers

• Just one of the well planned construction features of these widely used Reducers, is the "Gear Arrangement" in the Double and Triple Reduction Type . . . the gears are located symmetrically in relation to the centerline of the housing, rather than the usual offset arrangement. It will be noted that 2 standard bearings are used on each shaft and *each bearing absorbs an equal load.* (In comparison to the offset arrangement of Herringbone Gears, which result in unequal bearing loads, while similar arrangement of single helical gears impose an additional load by the thrust action) . . . It is evident then, that Philadelphia Herringbone Reducers with double helical gears spaced equidistant from the bearings in the first and intermediate reductions, with a continuous tooth herringbone gear set on the centerline for final reduction, *provide perfect balance and symmetry.*

For complete construction details, get our Catalog H-49. Please write on your Business Letterhead.

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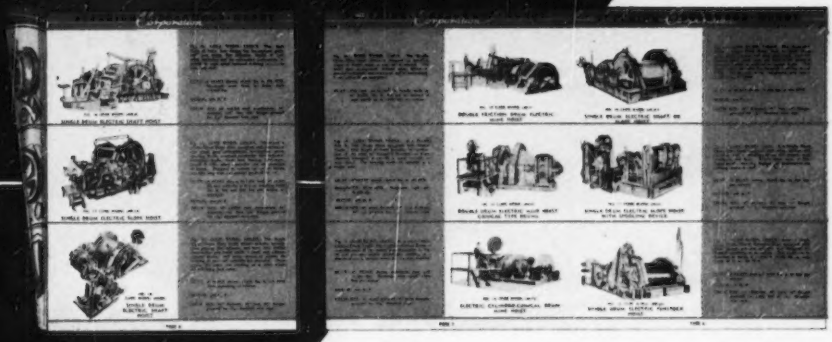
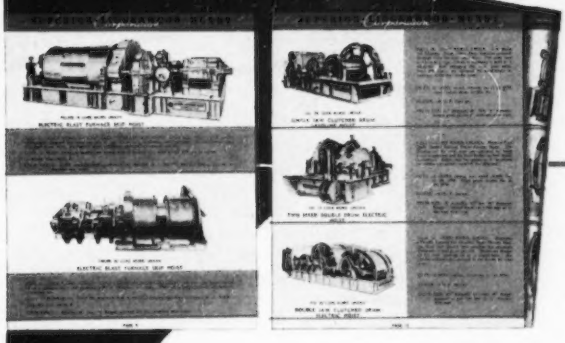
Industrial Gears and Speed Reducers
LimiTorque Valve Controls

Get this Catalog!

It contains information that will help solve your hoisting problems!





Hot off the press and yours for the asking, this catalog illustrates and describes a full range of mine, shaft, incline and special hoists engineered for specific purposes, *yet consisting of standard parts!*

Unusual? Not when Superior-Lidgerwood-Mundy does it! Many years' experience has provided designs covering a full range of such hoists, and this new catalog suggests various types which can be supplied by modifying and recombining standard parts.

You will also find data required for estimating on mine, shaft and incline hoists . . . general information on mine hoists and hoists for shafts and slopes . . . and a list of Superior-Lidgerwood-Mundy products which have been tested and proved for over seventy-five years in contracting, mining and industrial service.

We also build hoisting machinery for special purposes regardless of capacity and power required. Send us your specifications. We will be glad to consult with you without obligation.

Write for your copy of Bulletin M515 NOW... It will be a valuable addition to your technical library.

OVER 200 YEARS OF ACCUMULATED EXPERIENCE — SUPERIOR — LIDGERWOOD — MUNDY — 1851 — 1951

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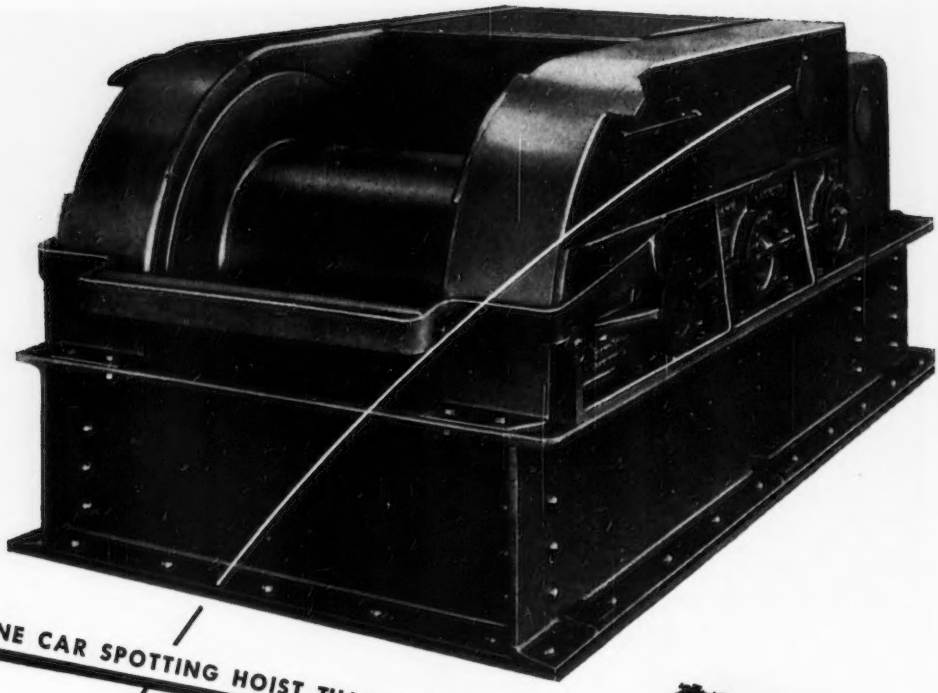
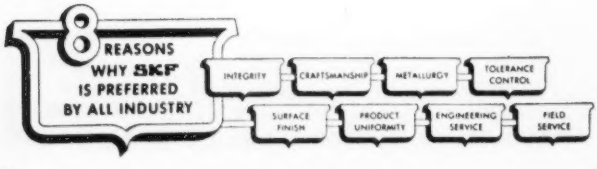


MINE CAR SPOTTING HOIST THAT PACKS THE PULL OF A 40-TON LOCOMOTIVE

. . . AND IT'S SKF-EQUIPPED

Model HKR Car Spotting Hoist, made by Brown-Fayro Company, Johnstown, is compact, sturdy and plenty powerful. It's rated at 18,000 lb. normal rope pull at 35 fpm. . . . equivalent to the drawbar pull of a 40-ton locomotive. Intermediate shafts are carried on SKF Self-Aligning Ball Bearings. That's a wise choice . . . but it's only natural. Time and again, SKF Bearings have demonstrated their complete dependability and efficiency under the toughest, most trying kinds of operating conditions. Reason is . . . SKF Bearings are designed, engineered and made by men who pioneered the Self-Aligning Ball Bearing. They're manufactured to rigid standards of craftsmanship . . . meticulously inspected . . . packed to reach the user in the same "final inspection" condition they left the plant. SKF Engineers are always anxious to work with you in designing for maximum efficiency and economy.

SKF Industries, Inc., Philadelphia 32, Pennsylvania. The Pioneers of the Deep Groove Ball Bearing – Spherical Roller Bearing – Self-Aligning Ball Bearing. 7076

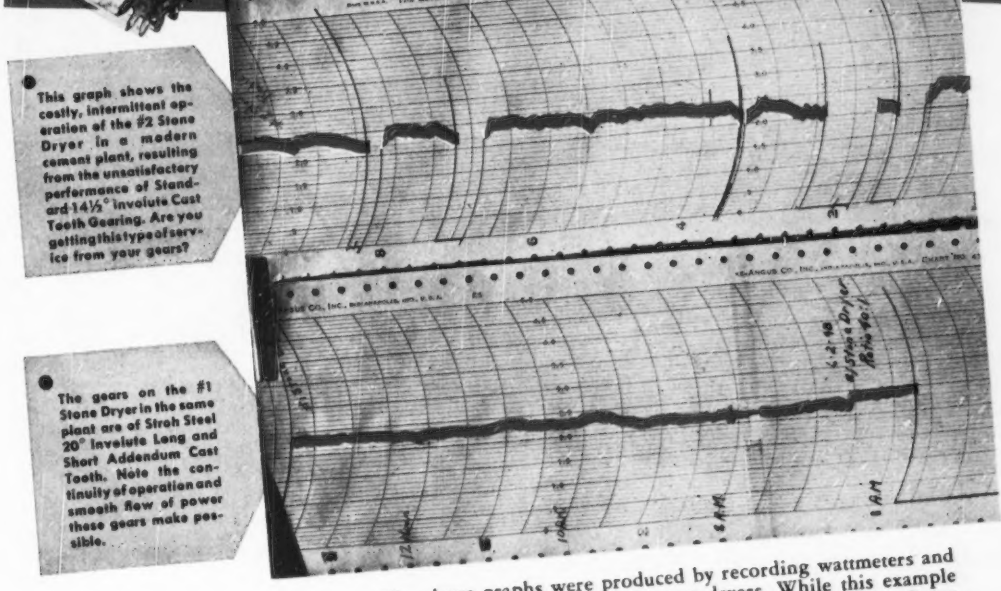


SKF

BALL AND ROLLER BEARINGS

Compare THESE GRAPHS !

...see how GEARS ENGINEERED BY **Stroh** INSURE CONTINUOUS, ECONOMICAL SMOOTH FLOW OF POWER



This graph shows the costly, intermittent operation of the #2 Stone Dryer in a modern cement plant, resulting from the unsatisfactory performance of Standard 14½° involute Cast Tooth Gearing. Are you getting this type of service from your gears?

The gears on the #1 Stone Dryer in the same plant are of Stroh Steel 20° Involute Long and Short Addendum Cast Tooth. Note the continuity of operation and smooth flow of power these gears make possible.

The above graphs were produced by recording wattmeters and show the power input on the two dryers. While this example illustrates the superior performance of Stroh gears on Stone Dryers, they are equally as efficient on kilns—coolers—tube, rod, ball mills and all similar applications.

The smoother flow of power on the #1 Dryer resulted from the use of *Stroh Steel 20° Involute Long and Short Addendum Cast Tooth Gearing.*

Wear-resistant Stroh Alloy on the active contour of the gear teeth maintains their original contour and insures continuity of a smooth flow of power.

On receipt of your inquiry, we will gladly supply further data on your specific problem without obligation. Write today.

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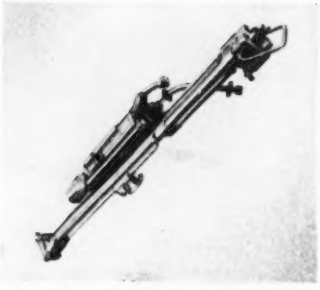
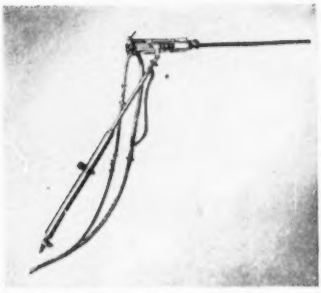
CAST OR CUT TOOTH CARBON STEEL GEARS

Holman pneumatic plant and tools for higher output, better work, lower costs . . .

HANDRILS. Hand-held rock drills. Powerful, fast and economical. Various types to suit all needs.



ROTOFEED DRIFTERS. Lightweight motor fitted to Drifter eliminates hand-cranking. Drilling speed is retained and rapid retraction reduces time taken to drill a round.



AIRLEG. For supporting Handrils. Provides uniform feed pressure, enabling holes to be drilled in any direction with minimum manual effort.

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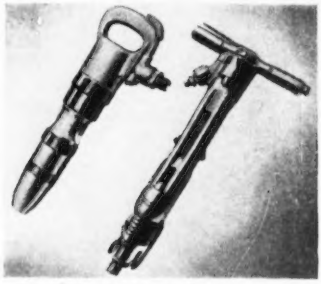

PICKS AND ROAD RIPPERS. High power with low air consumption. Types and sizes for all classes of work.

PORTABLE COMPRESSORS. Two-stage, powered by Heavy Duty Diesel Engines. Displacement from 130 to 360 cu. ft. Also Stationary Compressors from 80 to 612 cu. ft.

No high-powered sales-talk, this, but stone-cold fact. All the evidence is to be found in reports on Holman machines from engineers and miners all over the world—from Buenos Aires to Bangkok, from Reykjavik to Johannesburg. . . . In every industry that uses compressed-air plant and tools the name of Holman is accepted as a standard of efficiency and loyal after-sales service.

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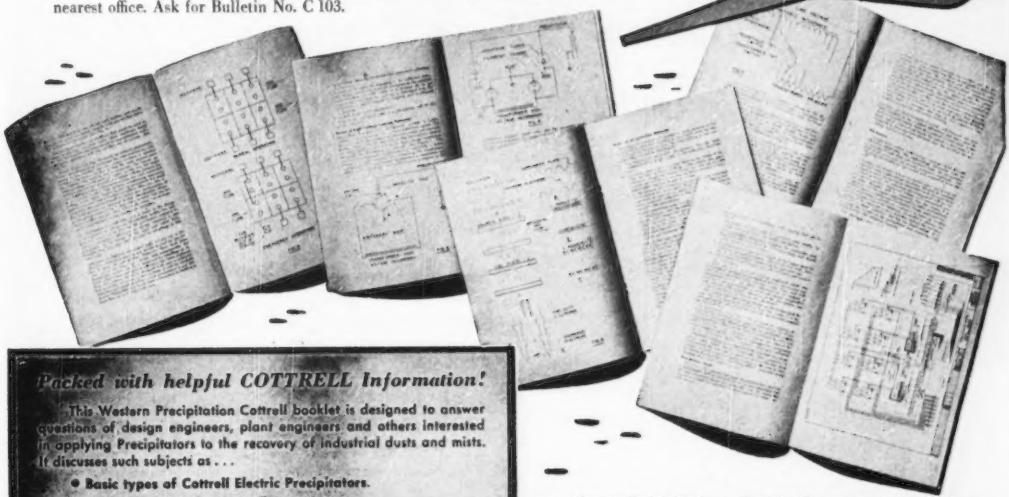
Western Precipitation pioneered and installed the first commercial application of the well-known COTTRELL Electric Precipitator—Dr. Cottrell, the inventor, being a member of the company. And for more than 42 years Western Precipitation has consistently led in developing new COTTRELL advancements and techniques for recovering suspensions from gases, both wet and dry.

This 28 page booklet summarizes many of the basic facts you should know about modern COTTRELL Precipitators—the various types available, how they operate, principal types of electrode systems and rectifiers, shell constructions, etc. As long as the supply lasts, a free copy will be sent you on request to our nearest office. Ask for Bulletin No. C 103.

28 PAGES
of helpful facts to know about
COTTRELL ELECTRICAL PRECIPITATORS



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This Western Precipitation Cottrell booklet is designed to answer questions of design engineers, plant engineers and others interested in applying Precipitators to the recovery of industrial dusts and mists. It discusses such subjects as...

- **Basic types of Cottrell Electric Precipitators.**
- **Principal parts of a Cottrell Precipitator.**
- **Mechanical and Electronic Rectifiers.**
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- **Removal of Collected Material.**
- **Factors in Shell Construction (steel, concrete, brick, etc.).**
- **Operating Efficiencies and the Effect of Various Factors on Performance.**

...and many other basic Cottrell facts. Write for your free copy of Bulletin C103 today while supplies are adequate!

Western Precipitation is not affiliated with any other company in the field of electrical precipitation except its wholly owned subsidiaries, International Precipitation Corporation and the Precipitation Company of Canada, Ltd. Whether you are now contemplating the installation of a Cottrell Electrical Precipitator, or may be interested in such an installation at a future date, we can and will serve you in any part of the United States or other countries.

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COTTRELL Precipitators
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...in all parts of the U.S.A. and foreign countries.

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This big machine is engineered and constructed for extra-heavy duty. It has met with enthusiastic acceptance, and is setting new performance records on coal stripping and mining operations.

Features include: "precision" air control of all operating functions; anti-friction bearings at all vital bearing points including drums, cone rollers and hook rollers; Large, grooved drums – tapered for shovel operations; truck base and rotating base of heavy one-piece annealed cast steel; extra sturdy construction; easy accessibility of all parts requiring lubrication or maintenance; Hamilton Diesel power plant—plus many other features for maximum performance and availability.

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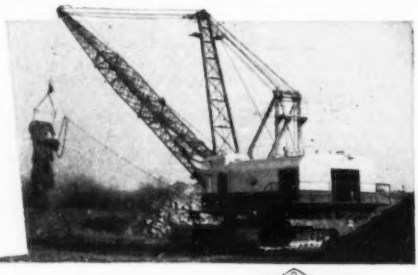
LIMA Rubber Mounted Cranes are Available in 20 and 35 Tons Capacity



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LIMA, OHIO

OTHER DIVISIONS: *Lima Locomotive Works Division; Niles Tool Works Co.; Hooven, Owens, Rentschler Co.*

LIMA HAMILTON CORPORATION

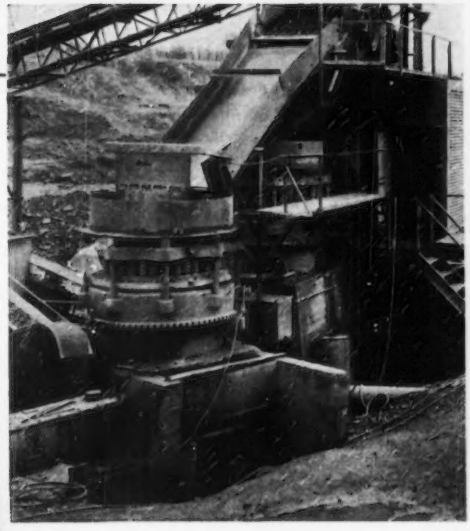
At Mary Ellen Mine—heavy media plant in building at left; conveyor on right delivers ore from crushing plant in pit *(see picture below)* where Telsmith Gyraspheres do fine crushing.

crushing BANDED TACONITE with TELSMITH Gyraspheres

ON THE MESABI IRON RANGE

On the Mesabi Iron Range of Minnesota, the Stanley Mining Co., Biwabik, Minn., is mining and treating banded taconite. Here their Mary Ellen Mine has two Telsmith Gyraspheres (shown at the right) which have, for the past two years, been doing a right good job of fine crushing for the mill feed. Plus 2-in. material passes to one No. 48 Telsmith Gyrasphere, with coarse crushing concave bowl, set at 1-in., and in closed circuit with a screen. Minus 2-in. plus ¾-in. oversize from the screen's bottom deck passes to a second No. 48 Telsmith fine concave Gyrasphere, set at ⅝-in., and thence to the beneficiation plant.

The *new* Telsmith heavier design Gyraspheres have a longer crushing stroke for greater capacity and a finer, more uniform product and new mechanical features for lower up-keep and longer life, resulting in lower crushing cost per ton.



Min-32

Get *New* Bulletin 274
describing all the new design and mechanical improvements of Style S Standard and Style FC Fine Crushing Gyraspheres.

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When production groans to a halt because of broken or fractured equipment, many shop-owners would gladly pay the price of gold for the few ounces of bronze needed for a reliable repair-weld.

They don't have to, of course. For repair-welding with Anaconda Bronze Rods—particularly Tobin Bronze*—is a low-cost, low-temperature method of oxyacetylene welding on cast or malleable iron, steel or copper alloys.

Over the decades that time-tried Tobin Bronze has served so well, many "new" rods and procedures have sprung up with mushroom-like growth, only to disappear as quickly—victims of their own lack of dependability!

Whether you do your own repair welding or call on outside help, play it safe—insist on genuine Tobin Bronze.

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Plastic Reinforced Primacord is recommended for "down" lines where you formerly used Wire Countered Primacord.

1. To make the most effective hookup, use a simple clove hitch in the *ground* line, as shown in these three photographs.

2. The twin loops have been folded over to form a hole.

3. Pass the Plastic Reinforced Primacord through this hole and draw the knot up *tight.*

P-1

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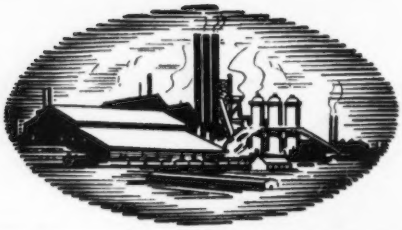

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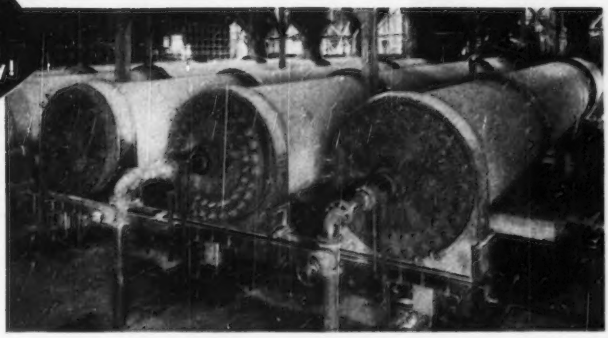

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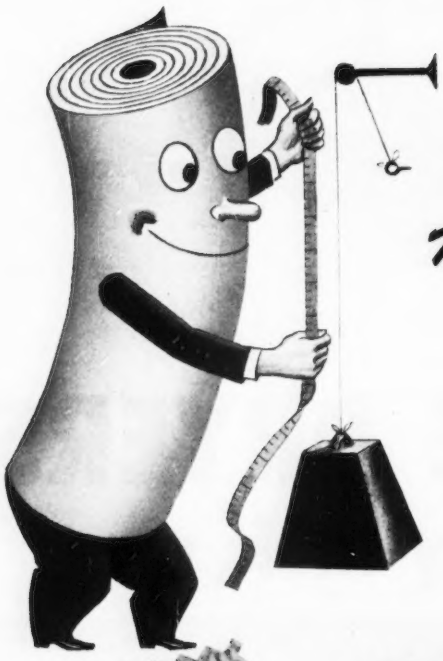

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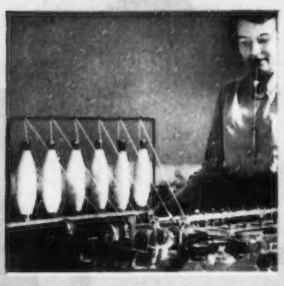

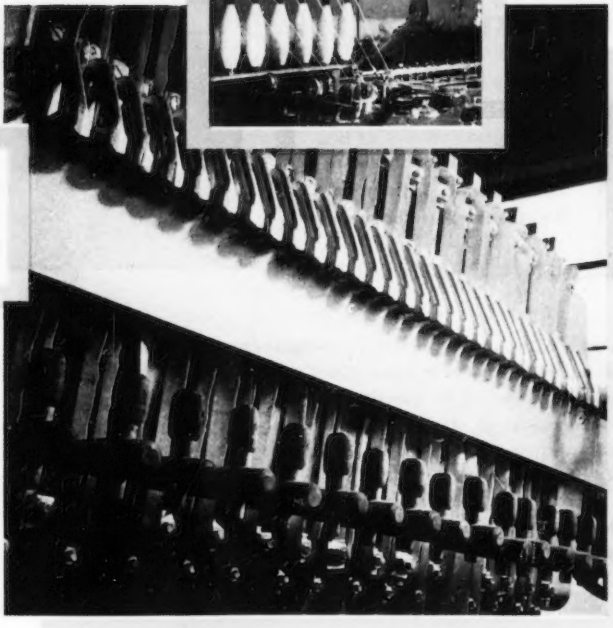

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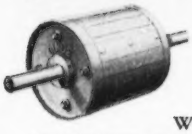


MAGNETIC PULLEYS

WHERE applicable, pulleys are the ideal answer for automatic removal and discharge of tramp iron. Used as head drive pulleys in belt conveyor systems or as head pulley in a complete separator unit which can be fed from a belt or a chute.

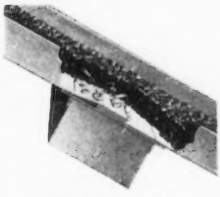
Dings non-electric, permanent, Alnico magnet Perma-Pulleys are recommended where burden depths are not much in excess of 3". Electromagnetic pulleys recommended for heavier burdens. *Ask for Catalog C-1007A covering Perma-Pulleys or C-1001A covering electro pulleys.*

SUSPENDED MAGNETS

for installation above belts or chutes.

THESE are the most powerful tramp iron magnets manufactured. Heavy-burden models have been supplied where the magnet face could not be placed closer than 18" to the conveyor belt.

Self-cleaning suspension magnets with a power driven cross belt are available to sweep iron from the magnet face and discharge it to the side. Fully automatic operation eliminates manual cleaning of magnet face. *Ask for Catalog 301-A.*



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for installation in the bottom of open or closed chutes.

POWERFUL Dings rectangular electromagnets are recommended for most installations in chutes. Material to be separated flows over the face of the magnet. Iron is attracted and held fast. Can be supplied with safety gate to automatically discharge iron. *Ask for Catalog 301-A.*

Dings also makes non-electric Alnico Perma-Plate magnets for installation in spouts and chutes. These are recommended only for light burdens. *Literature on request.*

MAGNETIC DETECTORS

THESE units, used in conjunction with belt conveyors, are designed to actuate a signal and stop the belt when iron passes through them. Operator then removes the iron. They are recommended where iron is encountered infrequently or in the unusual cases where belt speeds are so great or burden depths so heavy that magnetic pulleys or suspended magnets cannot be relied upon completely. *Write for Bulletin B-1901A.*

• *Dings also manufactures a complete line of separators for concentration and purification of minerals and for purification of ferrous media in heavy media separation plants. Ask for details.*

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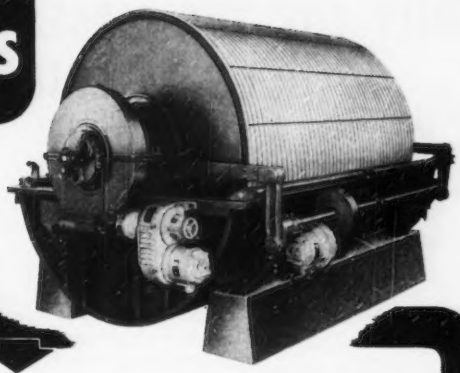

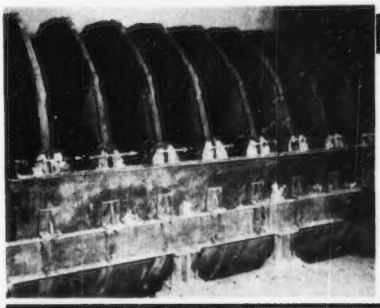

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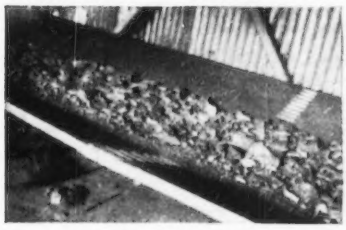

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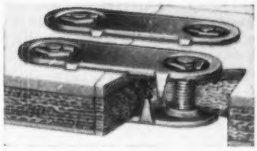

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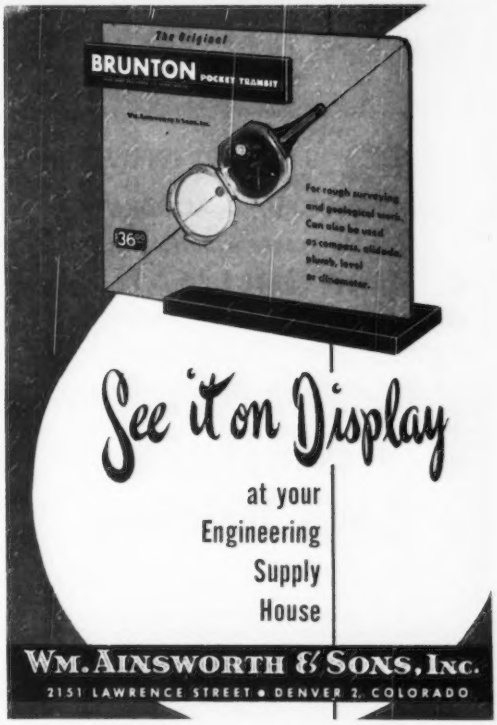
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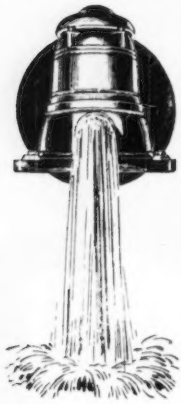

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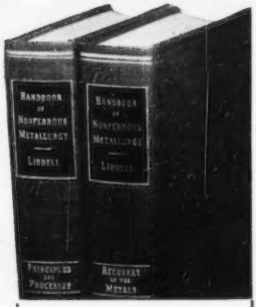

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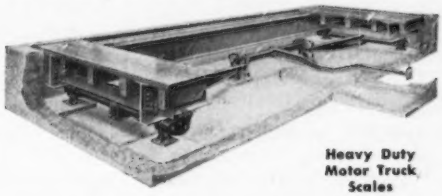

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Blake Type Rock Crushers—Heavy Duty Crushing Rolls — Pillow Blocks — Elevator Buckets — Ore Washers — Pulleys for Elevator and Conveyor

Send for Catalogs.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

Not available for equipment advertising

$1.20 a line, minimum 4 lines.

To figure advance payment count 5 average words as a line.

INDIVIDUAL EMPLOYMENT WANTED undisplayed advertising rate is one-half of above rate, payable in advance.

PROPOSALS $1.20 a line an insertion.

INFORMATION:

BOX NUMBERS care publication New York, Chicago or San Francisco offices count as one additional line in undisplayed ads.

DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:

The advertising rate is $9.75 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches to a page. E.M.J.

NEW ADVERTISEMENTS received by 10 A.M. April 20th will appear in the issue of May subject to limitations of space available.

REPLIES (Box No.): Address to office nearest you

NEW YORK: 330 W. 42nd St. (18)

CHICAGO: 520 N. Michigan Ave. (11)

SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

(Additional Position Vacant ad on page 180)

WANTED—SUPERINTENDENT of Maintenance: Large national manufacturer has opening available for Maintenance Superintendent for bauxite mines in Arkansas. Prefer a man with a Mechanical Engineering Degree or background who is thoroughly versed in the handling and maintenance of shovels, tractors, drills, hoists and other mining equipment. Send resume, including age and salary expected, to P 6099, Engineering & Mining Jl.

METALLURGIST—MILL Foreman, college graduate, experienced ore dresser and mill operator, standard three year contract, salary $5,000 yearly, plus bonus one month yearly, single status or if married single status for six months, working knowledge Spanish essential, free transportation to Bolivia by air for employee (and wife if married), four weeks vacation yearly, free living quarters. P 2392, Engineering & Mining Jl.

SENIOR MECHANICAL ENGINEER. Progressive manufacturer of equipment for cement, lime and metallurgical plants requires a design and mechanical engineer. Previous experience necessary. State experience, salary desired and references to P 2553, Engineering & Mining Jl.

MINE FOREMAN, college graduate, experienced metal miner, standard three-year contract, salary $4,200 yearly, plus bonus one month yearly, single status for six months, working knowledge Spanish essential, free transportation to Bolivia by air for employee (and wife if married), four weeks vacation yearly, free living quarters. P 2391, Engineering & Mining Jl.

JUNIOR METALLURGIST, college graduate in ore dressing, some experience ore dressing laboratory test work, standard three-year contract, salary $3,000 yearly, plus bonus one month yearly, single, knowledge Spanish desirable, free transportation to Bolivia by air, four weeks vacation yearly, free living quarters. P 2390, Engineering & Mining Jl.

MINE-MILL Superintendent, small gold-copper mine, Chile, Flot-Cyanide Mill, Med. elevation, healthy climate, Spanish required, single status. Reply fully to P 6068, Engineering & Mining Jl., stating background, experience, references, salary desired.

POSITIONS WANTED

ELECTRICIAN. GO anywhere in U. S. or North. 30 yrs. experience mine-mill elect. installation and maintenance. A-1 on locomotives, power circuits, control, generator-motor winding A.C. or D.C. Best results in charge of elect. dept. Will accept lead electrician or do straight all around elect. work. References furnished. Available on 15 days notice. Married, 49. Housing not required for awhile. PW-2122, Engineering & Mining Journal.

METALLURGICAL GRADUATE now employed as mill superintendent in medium sized operation. 17 years experience in responsible position U. S. and S. A. Married, 1 child. Desires position with a future either domestic or foreign. Reply PW 2459, Engineering & Mining Jl.

MINE OFFICE Manager, experienced all phases mine and mill accounting desires permanent position. Married, with two children. Reply PW 2439, Engineering & Mining Jl.

MINING ENGINEER experienced examination, development and operation, domestic and foreign. Competent technical reports and general engineering. Age 47, good health, married. PW 2476, Engineering & Mining Jl.

MINING ENGINEER, with proven ability for successful mining operations. Extensive administrative knowledge, speak Spanish, available as manager or superintendent. PW 6090, Engineering & Mining Jl.

(Continued on page 180)

Experienced *OPERATING STAFF* required for newly developed modern Copper property in North-Eastern Turkey, minimum two years service contract:

(a) CONCENTRATOR SUPERINTENDENT—1,500 ton per day differential flotation plant.

(b) SMELTER SUPERINTENDENT—Wet charged Reverberatory, Waste Heat Boiler, Horizontal Converters, 35/40 ton Refining Furnace, Casting Machine, etc. Pulverized coal firing.

(c) CONCENTRATOR SHIFT FOREMEN.

(d) SMELTER SHIFT FOREMEN for all departments.

(e) CHIEF ASSAYER-CHEMIST.

Operations start latter half 1950 but Superintendents required at Site few months before. Applicants must be experienced, active and in good health. Write for details stating fullest particulars, qualifications, experience, age, salary required, etc., to the Consulting Engineers, British Geco Engineering Co., Ltd., Adelaide House, London Bridge, London, E. C. 4, England.

POSITIONS WANTED

(Continued from page 179)

MECHANICAL AND Structural engineer, 25 years experience domestic and foreign, desires foreign position as assistant or chief engineer. Employed in this capacity. Age 47. Experienced in Mining, Milling & Smelting, equipment design and construction. Available June. PW 6043, Engineering & Mining Jl.

MINING EXECUTIVE. E.M. (Geology) Degree in 1910. Speak Spanish. No preference as to location. Ten years experience as mining geologist. Twenty years experience in supervisory positions with large mining company in South America. Successful in labor relations. Excellent references. PW 6151, Engineering & Mining Journal.

BUSINESS OPPORTUNITIES

For Sale or Lease

Millions of tons of diatomite. Good location and climate. Shovel or dozer extraction. Geo. Coverston, Fallon, Nev.

Dump Ore, Tailings

Silver Hill Mine. 20,000 to 25,000 tons; lead-zinc-gold-silver. Ideal milling conditions. Will sacrifice. T. A. M. Stevenson, Winston-Salem, N. C.

WANTED

Complete assay equipment for gold, silver, copper, and lead ore. Box 325, Idaho Falls, Idaho.

OPEN PIT MINING

Contractor with excellent equipment and experienced personnel interested in excavating, material handling, or open pit mining work.

CW1319—Engineering & Mining Journal
330 W. 42nd St., New York 18, N. Y.

SHOVELS: Bucyrus Erie model 170-B, 6 yd. capacity, 2200 volt, A.C., built 1947. Also, 120-B, 4 yd., electric.
TRUCK CRANE: Bay City 20 ton with 80 ft. boom mounted on 10 wheel Cranemobile truck.
BALL MILLS: Hardinge 8′ x 30″ manganese lined with or without 100 H.P. motor and drive. 5′ x 22″ manganese steel lined with motor and feeder. 6′ x 36″ silex lined. 8′ x 20″ minus lining.
DRYERS, KILNS, COOLERS, ETC.:
1—Allis Chalmers 10′ x 90 ft., single shell, heavy duty, with or without furnace, exhauster, dust collector, motors, etc.
2—Ruggles Coles 90″ x 60 ft., class XF14, and 1—80″ x 60 ft. class XF12, oil fired, with fan, burner, dust collector, etc.
1—Traylor 54″ x 40 ft., oil fired, single shell.
1—Rotary Kiln 72″ I. D. x 42 ft., brick lined, complete with all accessories.
1—Rotary Cooler 48″ x 45′6″ complete with all accessories.
1—Ruggles Coles 60″ x 35 ft., class F8, single shell.
HAMMER MILL: Jeffrey 24 x 36.
REDUCTION CRUSHERS: Symons 5½ ft., short head. Symons 3 ft. and 2 ft. standard. Telsmith 24″ Gyrasphere. Traylor 36″ type TY.
ROLL CRUSHER: Allis Chalmers heavy duty 54 x 20″. V-belt pulleys, manganese fitted. New condition.
JAW CRUSHER: Farrell 15-B, size 24 x 36″, manganese fitted, with or without motor and drive.
DRAG SCRAPER UNIT: Sauerman 3 yd. Crescent bucket, 150 H.P., two drum Holst.
OVERHEAD TRAVELING CRANES: 2—62 ft. span, 10 tons capacity, three motors, 5, 10 and 12 H.P., 3 phase, 60 cycle, 440 volt. NEW condition. With or without runway and uprights.
SCREEN: 5 ft. x 14 ft., double deck, 15 H.P. motor.
ELECTRIC MINE HOISTS:
1—Vulcan all steel, 8 ft. dia. drum, 64,000 lbs. single line pull, 600 FPM, 1⅛″ rope, 400 H.P., 2200 volt motor and all control equipment. NEW condition.
1—Single drum 8′ dia., 1⅛″ rope, 1000 H.P., 450 RPM, 2200 volt, with all control equipment.
1—Double drum 38″ dia., 42″ face, 150 H.P.

A. J. O'NEILL
LANSDOWNE, PA.
Phila. Phones: Madison 3-8300, 3-8301

DEPOSITS FOR SALE OR LEASE

IRON: Nevada's largest.
MANGANESE: State's second largest.
PERLITE: Three large deposits.
LOW GRADE FREE GOLD: Values in cleavages. Trommeling.
TITANIUM BEARING BLACK SAND: Several square miles. No crushing needed.
JASPER: Enormous deposit.
SILVER MINE: Cheap. Estate owning must be settled.
GOLD PLACER: Shallow ground.

C. C. BOAK
Tonopah, Nevada

CAPITAL WANTED

After obtaining proven productive high grade gold property in Georgia with record of carload smelter shipments and U. S. Bullion payments need small amount capital, with or without operator, to increase production and develop large body practically pure magnetite ore. Will bear closest scrutiny and investigation.

Reply BO 6113, Engineering and Mining Journal,
330 W. 42nd St., New York 18, N. Y.

CHROME SACRIFICE

170 A Chrome Deposit. Estimate of 100,000 tons disseminated Chrome mixed with yellow Ochre on ore Claim. Gov't average analysis 55% Chromic Oxide. Very low iron content. Surface just scratched. Only 40 tons Chrome Ore Mined. Wonderful opportunity here. Owners old. SACRIFICE for $35,000.

P. O. Box 368, Auburn, Cal.

BUSINESS OPPORTUNITY

Experienced geologist seeks capital backing for application of new and technically sound technique of mineral prospecting. For details write

BO 2444, Engineering & Mining Journal
330 W. 42nd St., New York 18, N. Y.

Complete Steam Power Plant
FOR SALE, INCLUDING

BOILER: One Babcock & Wilcox Marine boiler with a fire-surface of 6,600 sq. ft. and 170 psi steam-pressure, chain grate, coal conveyor, feeding-pumps for water, water-tank with water-scale, etc.

TURBO-GENERATOR SET: Turbo-generator set consisting of two 1,000 KW de Leval-ASEA steam-turbine generators for 3 phase A.C. 6,000-6,500 V. 25 cycles, 1,500 rpm, surface condenser, pumps, valves, pipings, etc.

SET OF INSTRUMENTS: Set of instruments including all instruments necessary for the running of the generators, mounted on marble-slabs, interlocking plant for 6 KV with oil-switches, current-and voltage-transformers, etc.

The plant was built in 1911 but has been operating for a total of only 5 years, is in excellent condition and can be sold for immediate delivery. Further details may be obtained on request from the seller.

Luossavaara-Kiirunavaara Aktiebolag
Malmberget, Sweden

FOR SALE

Used Ottumwa hoist, cylindro-conical drum 12′, large diameter, driven by 1050 H.P.—AC—25 cycle 2300 Volt motor through steel pinion and gear. Motor is provided with full magnetic controls. Hoist has been handling pay load of 10 tons from a mine shaft 1063 feet deep. Hoisting cycle 70 seconds. An entirely new drum shell, kept as a spare, goes with this hoist.

***Address inquiries to* General Manager**
International Salt Co., Inc.
Retsof, New York

WANTED

WANTED

Large engineering firm wishes to acquire several complete plants through purchase of (1) capital stock, (2) assets, (3) machinery and equipment whole or in part. Personnel retained where possible, strictest confidence.

Box 1231, 1474 Broadway, New York 18, N. Y.

BUYERS OF SURPLUS COPPER, INSULATED WIRES AND CABLES
No lengths too long or too short
Telephone: EAstgate 7-4778
PIERCE CABLE CO.
2674 Clybourn Ave., Chicago 14, Ill.

SLUDGES WANTED

If you have any metallurgical or chemical by-product sludges which may contain rare or minor metals, please contact:
Metallurgical Process Division
Saratoga Laboratories, Inc.
Saratoga Springs, New York
Sludges bought outright or recovery processes developed under contract.

WANTED

60″ x 48″ Jaw Crusher
42″ Gyratory Crusher
THE NATIONAL LIME & STONE CO.
FINDLAY, OHIO

DEPENDABLE EQUIPMENT AT A SAVINGS IN TIME AND COST

LOCOMOTIVES

2—1½ ton Mancha "Little Trammer" battery, 18"-24" gauge.
2—2½ ton Mancha battery, 18"-24" gauge.
1—2½ ton Whitcomb battery, 24" gauge.
2—7 ton General Electric battery, permissible type, 36" gauge.
2—8 ton General Electric battery, 36" ga.
4—10 ton Atlas battery, 36" ga.
3—6½ ton General Electric trolleys, 36" ga.
2—18 ton Davenport steam locomotives, 1—18" and 1 standard gauge.
1—3 ton Whitcomb gas engine driven, 24" gauge.
1—3 ton Ruth gas engine driven, 18" ga.
1—5" x16" Porter compressed air, 18" ga.
1—5½"x16" Baldwin compressed air, 30" ga.

LIGHT AND POWER PLANTS

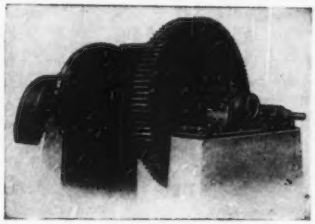
5—600 Pioneer Light Plants, gas engine.
4—1½ KW Homelite Light Plants, gas eng.
2—2½ KVA Leland Light Plants, gas eng.
1—3 KW Onan Auto. Light Plants, gas eng.
1—5 KW New Master Light Plants, gas eng.
1—20 KW West. light plants, gas engine.
3—15 KW Century Generators driven by Waukesha Hesselman Diesel engines.
1—30 KW Century Generator driven by Buda Diesel engine.
1—50 KW Western-Electric Generator driven by Cummins Diesel engine.

CONCENTRATING TABLES

5—Wilfley #6, left hand.
12—Deister "Plat-O," right hand.
43—Diester "Plat-O," left hand.

DRILL SHARPENERS

1—Sullivan port. Class E. "Little Smithy."
2—Ingersoll-Rand #5.
1—Ingersoll-Rand #40.
1—Ingersoll-Rand #50.



BALL AND ROD MILLS

1—30" x 24" New Morse Bros. Batch Mill.
1—4' x 4' Standard Ball Mill.
2—6' x 36" Hardinge Conical Ball Mills.
1—6' x 48" Hardinge Conical Ball Mill.
1—6' x 8' Marcy Ball Mill.
1—8' x 22" Hardinge Conical Pebble Mill.
1—3' x 8' Denver Eng. Works Tube Mill.
1—3' x 9' Ruth Rod Mill.
1—5' x 36" Hardinge Conical Ball Mill.
1—64½ Marcy Ball Mill.
2—8' x 60" Hardinge Conical Pebble Mills. Silex lined.

FILTERS

1—3' x 2' Morse All Metal Drum Filter.
1—3' x 4' Oliver Drum Filter.
1—4' x 5' Disc Morse Filter.
2—6' x 2' Disc American Filters.
1—6' x 3' Disc American Filter.

TUGGER HOISTS

5—I.R. Utility Air Hoists, Single Drum, 3 Model EU, 2 Model HU.
1—I.R. Size A-4NN-0J2 Drum Air Hoist.
1—Sullivan RH 5 11P Single Drum Electric Slusher Hoist.
1—Sullivan RH 7½ HP Single Drum Electric Slusher Hoist.
2—I.R. Size 107, 7½ HP Single Drum Electric Slusher Hoist.
1—I.R. Size 5NN-011 5 HP double drum electric slusher hoist.
1—I.R. Size 29-MNM-2D 20 HP Three Drum Electric Slusher Hoist.
1—Sullivan Model B-211 25 HP Double Drum Electric Slusher Hoist.
3—Sullivan Type HE 6½ HP D.C. Single Drum Electric Hoists.
9—Sullivan Type HDE6½ HP D.C. Double Drum Electric Hoists.

JAW CRUSHERS

3—4" x 6" New Morse Jaw Crushers.
2—8" x 8" Universal Semi-Steel Crushers.
1—8" x 12" Universal Semi-Steel Crusher.
1—8" x 24" Rogers Cast Steel Crusher.
1—9" x 15" Farrell Blake Type.
1—9" x 16" Cedar Rapids All-Steel Crusher.
1—9" x 16" New Morse Crusher.
1—9" x 21" Telsmith Jaw Crushers.
1—8" x 36" Universal All-Steel Crusher.
1—9" x 36" Cedar Rapids.
1—15" x 20" Universal All-Steel Crusher.
1—10" x 24" Allis-Chalmers Jaw Crusher.
1—24" x 36" Traylor "Type A."

THICKENERS

1—Morse #1 Thickener Mechanism and Superstructure for 8' x 6' Tank.
2—10' x 8' Wemco Low Head Thickener Mechanisms and Superstructures.
1—Morse #2 Thickener Mechanism and Superstructure for 16' x 8' Tank.

BETTER MACHINERY—IT'S FULLY RECONDITIONED

ESTABLISHED 1898

MORSE BROS. MACHINERY CO.

P.O. BOX 1708 DENVER, COLORADO, U.S.A. CABLE "MORSE

COMPLETE ORE-MILLING PLANTS · CONCENTRATION · FLOTATION · MACHINERY · CYANIDE · AMALGAMATION

General Office and Plant: 2900 BRIGHTON BLVD., DENVER, COLO.

COMPRESSORS

NEW AND REBUILT

— SALE OR RENT —
RENTAL PURCHASE
ALL MAKES — ALL SIZES
STATIONARY OR PORTABLE
GAS—DIESEL—STEAM—ELECTRIC

— PORTABLE —

SPECIAL—315 CFM—Ingersoll International UD-18 Diesel—4 Pneu.—Late Model—Rental Purchase Plan for Skeptics—Guaranteed.

AMERICAN AIR COMPRESSOR CORP.
47th & Dell Ave., North Bergen, N J.

DIESEL GENERATOR PLANTS

COMPLETE WITH SWITCHBOARDS
1000 KW to 100 KW
STATIONARY and PORTABLE
AT GREATLY REDUCED PRICES
NEW UNIT GUARANTEE

HERCULES ELECTRIC MACHINERY and EQUIPMENT CO.

Tel. NEvada 6-2808—Cable Address HEMCOY 1412 So. Alameda St., Compton, Calif.

MINES
MILLS
INDUSTRIAL PLANTS
MACHINERY
- ALL KINDS -

BOUGHT-SOLD LIQUIDATED

DULIEN STEEL PRODUCTS, Inc.
of Washington
9265 E. Marginal Way • Seattle 8, Wash. • LAnder 6000

BOILERS

10 to 1000 H.P.
NEW-USED RECONDITIONED
Steam, Gas and Electric Power Equipment

J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK CITY
MURRAY HILL 7-6547-8-9

Rotary Kilns—6½' x 70' & smaller. One 9' x 170'.
Rotary Dryers—3' x 30'—4' x 30'—6' x 40'—8½' x 50'—6½' x 60'—8' x 70'—7' x 60'.
Tube & Ball Mills—6' x 9'—5' x 22'—5½' x 18-7".
Fuller-Lehigh Mills—22"—42" & 52"—Bradley Mills.
Jaw Crushers—From 10" x 6" up to 36" x 24".
Crushing Rolls—From 16" x 10" up to 72" x 20".
1—7" Newhouse Crusher, latest type.
Sturtevant Rotary fine crushers—No. 0—No. 1—No. 1½ and No. 2.
Ring Roll Mills—Sturtevant No. 1—No. 2.
15'—16' & 18' Herreshoff furnaces.
Gyratory Crushers, No. 3 and No. 12.
8'—14' air separators.
Magnetic separators—jigs—screens—classifiers and thickeners.
5', 6' & 7' dia. Rod Mills.
Mine Hoists.
One 4 roll Raymond Mill, low side.
8' x 10'—8' x 12'—11½' x 19' Rotary Filters.

W. P. HEINEKEN
227 Fulton St., N. Y.

CARLYLE
INDUSTRIAL RUBBER PRODUCTS FOR EVERY PURPOSE

IMMEDIATE DELIVERY OF CONVEYOR, ELEVATOR AND TRANSMISSION BELTING — FIRE, WATER, SUCTION, AIR, STEAM AND WELDING HOSE

WHY WAIT

We have 8 to 48

RUBBER CONVEYOR BELTING

TOUGH COVERS—Heavy duty, specially compounded abrasive resistant rubber covers having high tensile strength. Thoroughly capable of withstanding the abrasive action of bulk materials. Properly vulcanized to the carcass to assure utmost performance, economically.

STRONG CARCASS — Constructed of finest quality 28 and 32 ounce tough cotton duck, properly treated and impregnated to avoid mildew from moisture and atmospheric conditions. Each ply thoroughly embedded in rubber to prevent ply separation.

FLEXIBILITY — Careful attention has been given in the construction of all belts to have the proper flexibility assuring the following desirable features; troughs easily, runs true on all idlers, gauge resistant, excellent for long and short hauls and slope installations.

Avoid delays in your production schedules!

We carry in stock for your immediate requirements, Conveyor Belting in widths from 8 inches to 48 inches.

Width	Ply	Thickness Top Cover	Thickness Bottom Cover	Type of Duck Carcass
8"	4	1/16"	1/32"	28 Oz.
10"	4	1/16"	1/32"	28 Oz.
12"	4	1/16"	1/32"	28 Oz.
14"	4	1/16"	1/32"	28 Oz.
16"	4	1/8"	1/32"	28 Oz.
18"	4	1/8"	1/32"	28 Oz.
20"	4	1/8"	1/32"	28 Oz.
20"	5	1/8"	1/32"	28 Oz.
24"	4	1/8"	1/32"	28 Oz.
24"	5	1/8"	1/32"	28 Oz.
26"	5	1/8"	1/32"	28 Oz.
30"	4	1/8"	1/16"	32 Oz.
30"	5	1/8"	1/16"	32 Oz.
30"	6	1/8"	1/16"	32 Oz.
36"	6	1/8"	1/16"	32 Oz.
42"	5	1/8"	1/16"	32 Oz.
48"	8	1/8"	1/16"	32 Oz.

INQUIRE FOR SIZES NOT LISTED.
ELEVATOR TRANSMISSION & V-BELTING ALSO IN STOCK

All our belting made by the leading belting manufacturers.

Write for Free Booklet on Installation Care & Maintenance of Conveyor Belting

SEND US YOUR INQUIRIES FOR OTHER RUBBER PRODUCTS.

CARLYLE RUBBER CO., Inc.
62-66 Park Place, New York 7, N. Y.
Phone: Digby 9-3810

If you're in the market . . THIS IS IT!!

2 EUCLID REAR DUMP TRUCKS

NEW—1947

MODEL —53 FD with 9-yard end dump bodies. Serial Nos. 6417 and 6416.

POWER —6-cylinder G.M. Diesels. Serial Nos. 671165463 and 671165461.

TIRES —Front 12.00x20—16 ply. Rear 14.00x20—20-ply.

Equipment includes 15-inch Hydrotarders, spare wheels, tires. Both units in excellent condition, used less than 2000 hours each. Motors completely overhauled by General Motors dealer, August, 1949.

SALE PRICE $12,500 EACH
F.O.B. Livingston, Montana

• These trucks are available for inspection at any time at COOKE, MONTANA

THE McLAREN GOLD MINES COMPANY
1054 LaSalle-Wacker Building **Chicago 1, Illinois**

FOR SALE
USED ROCK DRILLS

10 CP-60	Chicago Pneumatic Drifter Drills, Crank Feed	$200.00 ea.
15 DA-35	Ingersoll-Rand Drifter Drills, Crank Feed with New York Backhead	$350.00 ea.
2 DA-35	Ingersoll-Rand Power Feed Drifters with New York Backhead	$450.00 ea.
6 N-75	Ingersoll-Rand Drifters, Crank Feed	$ 75.00 ea.

WILL SHIP SUBJECT TO INSPECTION

WE MANUFACTURE ROCK DRILL REPLACEMENT PARTS FOR ALL MAKES AND TYPES OF ROCK DRILLS, DRILL COLUMNS, TRIPODS, AIR AND WATER VALVES, HOSE FITTINGS, AND DO HARD CHROME PLATING OF ROCK DRILL CYLINDERS.

MID-WESTERN MACHINERY COMPANY, INC.
Floyd F. Beechwood, Manager **Box 830, Joplin, Mo.**

MINE HOISTS

1—150 HP Double drum hoist with post brakes, air operated friction clutches, Lilly controls. 150 HP 2300 V. 3/60. Hvy. duty and would stand larger motor. 10,000± line pull.

1—100 HP double drum hoist, 440 volt and controls.

1—75 HP double drum hoist, 440 volt and controls.

1—100 HP Single drum Ottumwa hoist. Hvy. duty two brakes and friction clutch. 440 volt.

1—75 HP single drum Ottumwa hoist. Hvy. duty two brakes and friction clutch. 440 volt.

1—53 HP single drum Ottumwa hoist. Hvy. duty two brakes and friction clutch. 440 volt.

1—20 HP single drum Ottumwa hoist. Hvy. duty two brakes and friction clutch. 440 volt.

1—2000 cfm Worthington plate valve two stage air compressor with 350 HP direct connected synchronous motor. 2300 volt.

Mine hoists have just been removed from large Western mine and are ready for immediate shipment f.o.b. Reno, Nevada. Write for photographs and complete data.

F. J. SULLIVAN
672 Santa Ray Ave., Oakland, Calif.
Twinoaks 3-8342

PLACER EQUIPMENT

Trommel 4'x20', 80' stacker, 140' conveyor, 40 yd. hopper with feeder 4-cubic bowls, 4-cell P.A. jig, 5,000' 5" & 500' 8" pipe, 60 rubber riffles, power line, A.C. concentrator, complete camp, Ford truck, 20 yd. hour pilot plant, or complete Bodinson plant ready to go, 100 yds. hour, also dragline dredge.

DARRELL V. COLE
P. O. Box 1041 Wickenburg, Arizona

FOR SALE

1—8 to 10 yd. Electric Shovel, Marion Model 550; Rail-truck mounted; approx. 500 tons. Location, New York area.

Price $22,000

FS 2419, Engineering & Mining Journal
520 N. Michigan Ave., Chicago 11, Ill.

SURVEYING INSTRUMENTS

USED • REBUILT • SALE
RENT • REPAIRING

RELAYING RAIL
All Sizes
Track Accessories

LEFTON INDUSTRIAL CORP.
***Genl. Office:* 212 Victor St.**
St. Louis 4, Mo.

It costs no more
to have your instruments of any make
repaired by the makers of the
WORLD'S FINEST SURVEYING INSTRUMENTS
since 1871
C. L. BERGER & SONS, INC.
37 Williams Street, Boston 19, Mass.

Lead and Zinc Mine Liquidating Machinery and Equipment For Sale

Send for List.

K. T. Dome Mining Syndicate, Inc.
500-526 E. Front St., Cincinnati 2, Ohio
Phones: Cherry 0040-4633

If there is anything you want that other readers can supply

OR . . . *something you don't want*— that other readers can use—

Advertise it in the
SEARCHLIGHT SECTION

FOR SALE!

Endless Rope Haulage Hoist

at fraction of original cost

★

★ MADE BY WELLMAN ENGINEERING Co.

★ CONDITION NEW

★ PACKED FOR EXPORT

THIS Endless Rope Haulage Hoist was manufactured for a foreign government in 1945 and has been stored in its original export packing at a former U. S. Holding and Reconsignment Depot.

The haulages are designed for an effective haulage capacity or maximum working horizontal rope pull of 10,000 kilograms at a maximum rope speed of one (1) meter per second.

Drum diameter is 6' 6¾".

Rope: 1⅞" dia. 6 x 7 construction, hemp center, plow steel haulage rope, lubricated for overseas transportation, having a continuous - - one piece - - length of seven thousand and sixty (7060) lineal feet. Breaking strength of rope - - 127,000 lbs.

It is designed for operation on 380 volts, 3 phase, 50 cycle alternating current. Motor is Westinghouse, 200 h.p., 380/220 volts, 485 rpm, open, continuous 50 degree C rise, type CI, frame 32-C, wound rotor, ball bearing, with double straight shaft extension.

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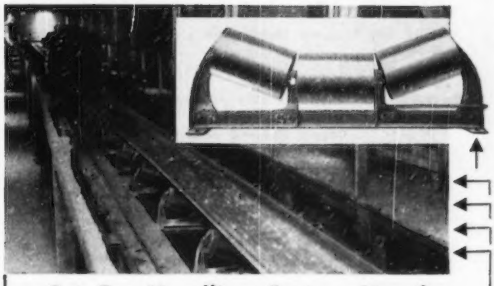

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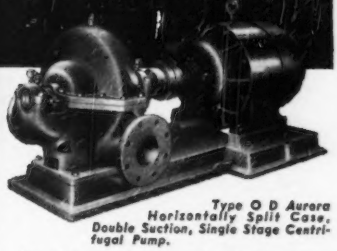

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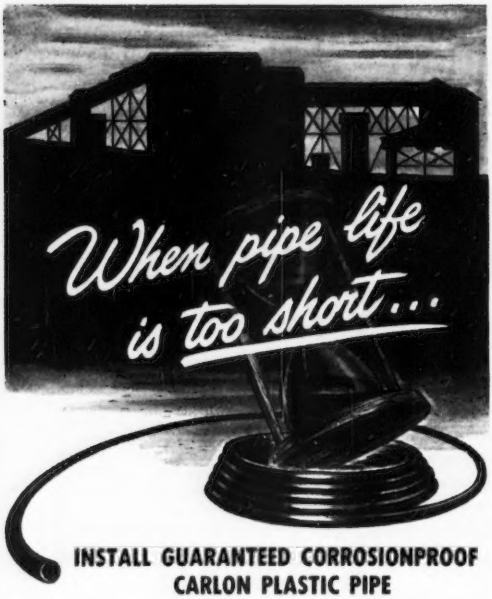

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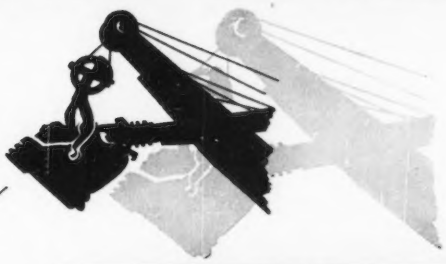

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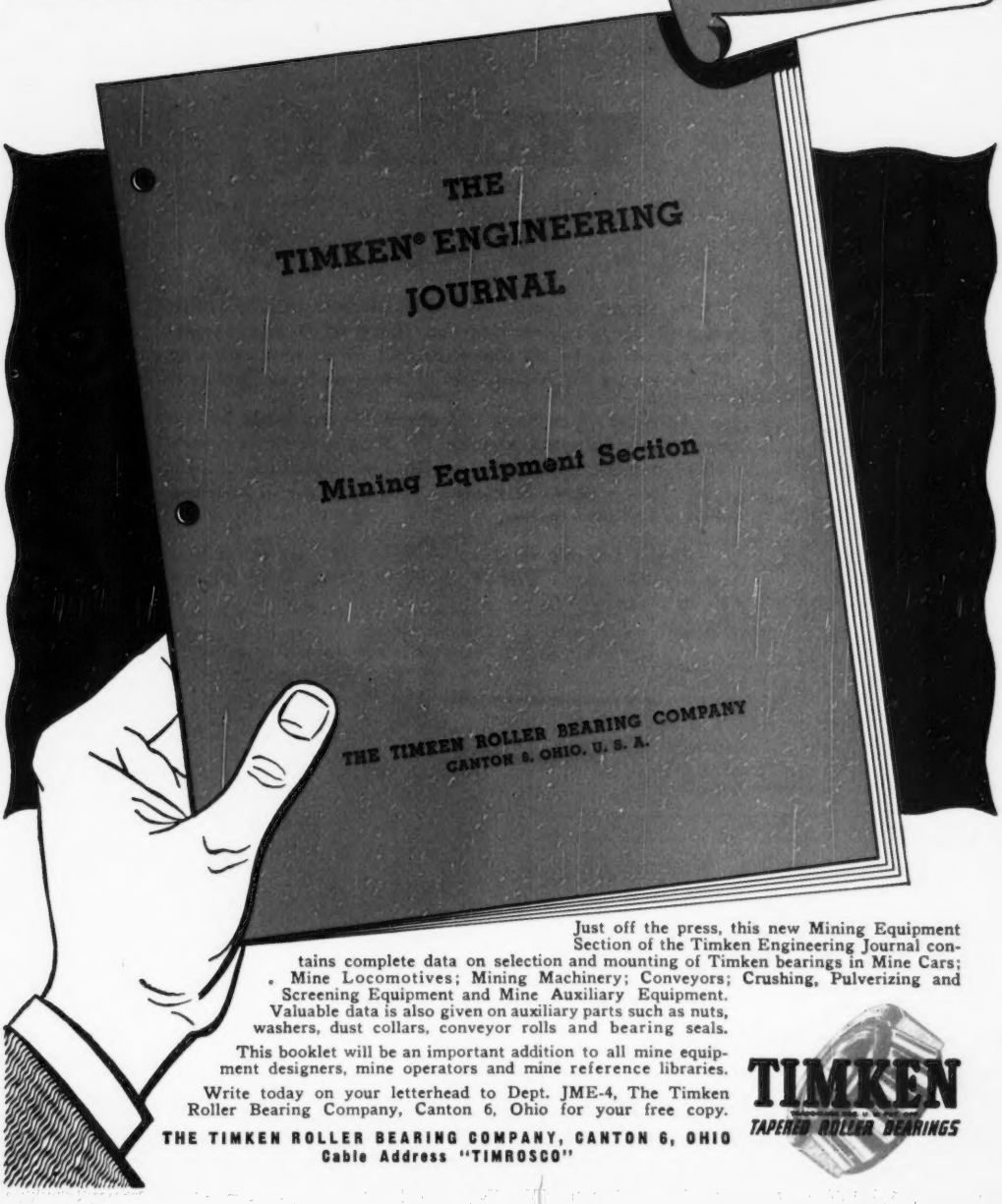

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